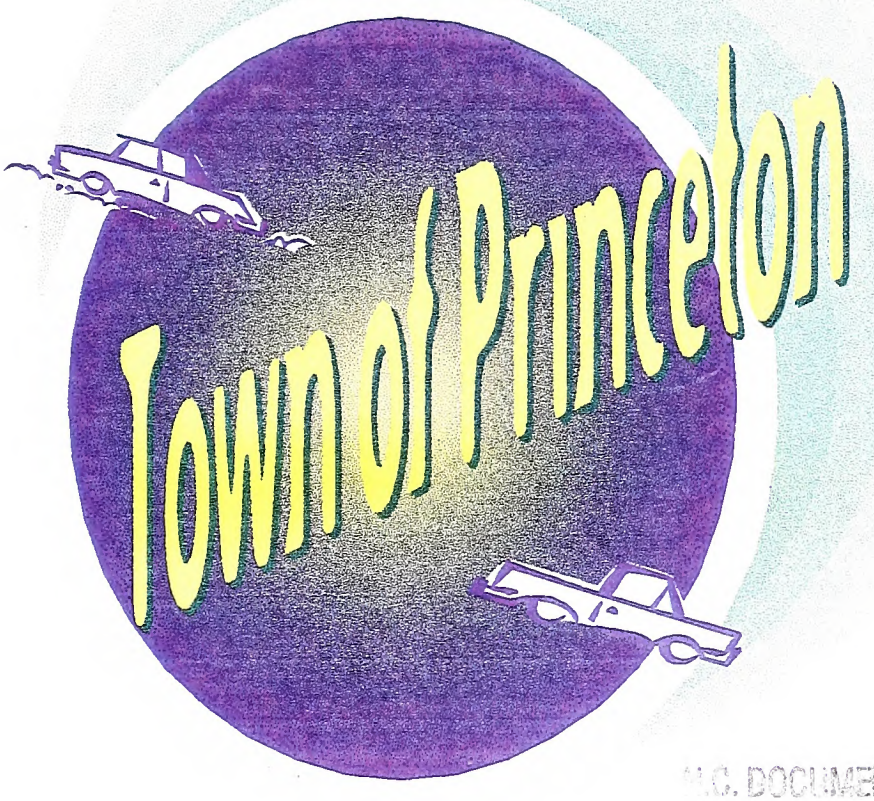
North Carolina Department of Transportation
Statewide Planning Branch

Thoroughfare Plan Report for the



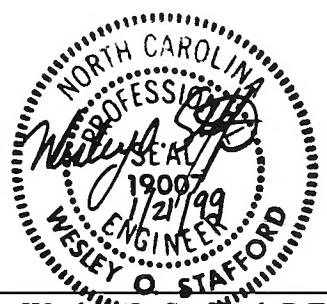
January 1999

Thoroughfare Plan Report for the Town of Princeton

Prepared by the: Statewide Planning Branch
Division of Highways
N.C. Department of Transportation

In Cooperation with: The Town of Princeton
The Federal Highway Administration
U.S. Department of Transportation

January 1999



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Acknowledgements

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David Holt, Mayor of Princeton

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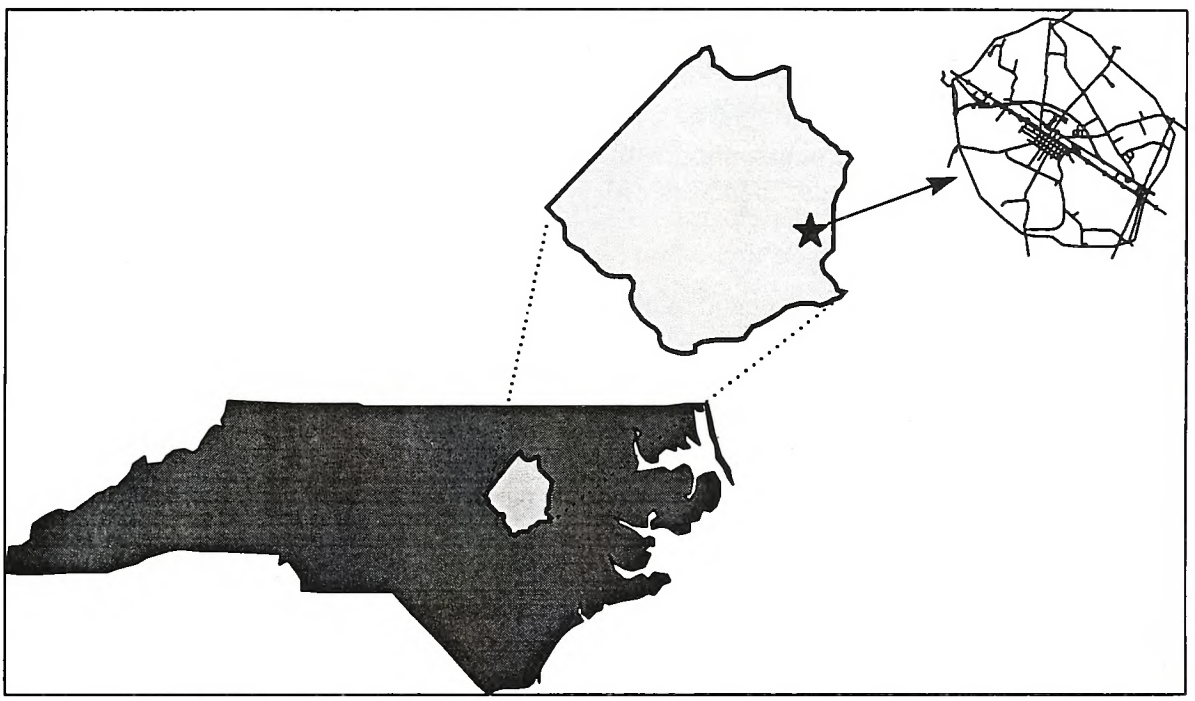
I. INTRODUCTION

Background

The Town of Princeton is a small residential community located in Johnston County. Princeton is located approximately seven miles west of Goldsboro and nine miles east of Smithfield. The geographical location of Princeton is shown in Figure 1.

Figure 1 - Geographic Location of Princeton, NC



The Town of Princeton recognized the importance of planning for future transportation needs, and requested thoroughfare planning assistance from the Statewide Planning Branch of the North Carolina Department of Transportation (NCDOT). This report documents the development of the 1998 Princeton Thoroughfare Plan, which is shown in Figure 2. This study was initiated in 1996 and is the first thoroughfare plan for the Town of Princeton.

Transportation Planning

The economic and social well being of the Town of Princeton depends upon the quality of the transportation facilities that exist in the area. If people are able to travel about freely in Princeton today and as the economy grows, then the transportation system has been planned to properly accommodate existing and future travel. A well planned transportation system will allow for economic growth, while simultaneously providing safe and efficient travel throughout the Town of Princeton.

This transportation plan is a joint effort by the North Carolina Department of Transportation and the Town of Princeton. This plan is intended to provide the Town of Princeton with the necessary roadway improvements to satisfy the anticipated transportation needs until the year 2025. The thoroughfare plan was developed based upon the current population, employment and travel trends in the area, as well as the Town's anticipated growth. It is important to realize that this plan is not a rigid set of proposals, but is intended to be flexible enough to account for changes in future growth. In all likelihood, this plan will be revised approximately every 8-10 years in order to re-evaluate the conditions in the Town of Princeton and to eliminate any possible adverse impacts of unnecessary transportation proposals.

Most of the improvements recommended in this report will be the responsibility of the NCDOT, but it is necessary for local officials, the local planning agency, developers and citizens of Princeton to assist in the implementation of this transportation plan. This plan should be used as a guide to protect areas in the Town where new or improved facilities may be located in the future and should be used in conjunction with the Town's land use plan, zoning regulations, and subdivision regulations in order to facilitate all types of planning that concern the Town of Princeton.

Most of the improvements recommended in this report are concerned with local streets and highways. This is due to the dependency on the private automobile by the public. It is important to realize that these are recommendations for what is felt will be the "best possible solution" to the transportation issues in Princeton. It is ultimately the decision of the Town of Princeton as to which recommendations they want to adhere to and to determine how close they follow these recommendations.

Why Plan & How?

One of the biggest influences in the development of the Town of Princeton is the effectiveness of the transportation facilities. Meaning, how well are the different areas of Town connected to each other by roadways, and are these roads able to handle the traffic in Princeton. These impacts need to be looked at to determine if changes to the transportation system are necessary in order to guide future development toward meeting the goals of the Town. To control the growth of the Town while simultaneously achieving community goals, planning is a necessity.

Transportation planning provides a wealth of benefits to small communities, larger regional areas and ultimately to the State of North Carolina. Planning is viewed as an integral part of the growth and success of the State of North Carolina, so important that a law established by the State of North Carolina in 1959, requires that each municipality develop a comprehensive street network plan that will serve the citizens now and in the future. Some of the reasons for planning of transportation systems includes:

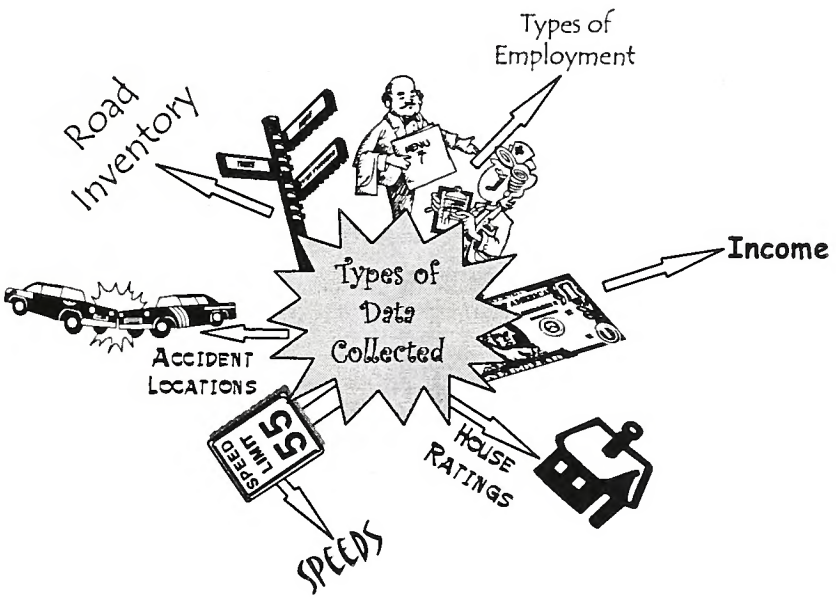

Minimizing land required for street & highway purposes


Each street can be designed for a purpose (bypass, neighborhood connector, etc.)

- *Savings in construction and maintenance of the roadways*
- *Citizens will know what the roads will look like in the future and can plan accordingly*
- *Developers will be able to design residential/commercial areas that will not interfere with the transportation plan*
- *Town officials will know when improvements are needed and can seek funding*
- *Minimization of damage to property owners and to the community appearance*

We know why to plan, but .....how to develop a plan? In order to plan the future transportation network, we must know everything possible about the community. The citizens of the Town are the biggest players in the development of the plan. Talking to people about what problems exist in the Town, what type of growth they expect, discussing what roads need improvement and the overall goals of the community is the biggest key to planning. If the citizens and officials know where they want to go in the future and what they want to happen to the local streets, then planning the transportation network is a lot easier.

A wealth of data is collected about the current roads, the travel patterns people use to get to their destinations (Do they use US 70 or local streets to go to the grocery store?) and what type of people live in Princeton. Other types of data, such as the ones shown below, are also collected and used in the planning process.



This information is used to build a "mini-city" version of Princeton on the computer, that will duplicate the real-world travel patterns and produce traffic volumes consistent with the 1995 counted volumes. The data can also be used to predict what is going to occur in Princeton in the future. The computer model aids in planning by helping to determine what new improvements will "fix" or improve the transportation network and ultimately a plan is developed based on the many different scenarios that are tested on the computer and developed by the citizens, Town officials and the North Carolina Department of Transportation.

This section answered the "How to Develop a Plan" but that is not where planning stops. Planning is a continuing process that involves corridor protection, development control, acquiring funding for roads and much more.

The purpose of this study was to examine present and future transportation needs of the Princeton area and develop a thoroughfare plan. The proposed system of thoroughfares was developed following the basic principles of thoroughfare planning as described in Chapter VIII of this report. The plan recommends those improvements which are necessary to provide efficient traffic circulation within the 1995-2025 planning period. The recommended cross-sections for these improvements are based on existing conditions and projected traffic volumes, and are outlined in Appendices C & D.

LEGEND

	Existing	Proposed
Major Thoroughfare	▬▬	▮▮▮▮▮▮▮▮▮▮▮▮
Minor Thoroughfare	▬▬	▪▪▪▪▪▪▪▪▪▪▪▪

ADOPTED BY:

TOWN OF PRINCETON	May 4, 1998
PUBLIC HEARINGS	March 2, 1998
RECOMMENDED BY STATEWIDE PLANNING	May 7, 1998
N.C. DEPARTMENT OF TRANSPORTATION	June 5, 1998

February 16, 1998

Figure 2

THOROUGHFARE PLAN

PRINCETON

JOHNSTON COUNTY
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 0.5 1
kilometers

800 0 800 1600 2400
feet

II. PRINCETON THOROUGHFARE PLAN

A Thoroughfare Plan examines the need for new facilities and improvements of existing facilities, plus identifies future and existing deficiencies in the transportation system. The Thoroughfare Plan for the Princeton Planning Area, shown in Figure 2, presents a recommended system of freeways and major and minor thoroughfares to meet design year traffic requirements. Appendix C of this report includes a street description for each of these thoroughfares, with associated traffic volumes and recommendations for improvements.

The adopted thoroughfare plan is based on results from a traffic computer model which used traffic counts, socio-economic data, and the existing street system. Major streets and highways in the planning area were analyzed based on their efficiency in serving future anticipated traffic and development. This chapter presents recommendations determined from these capacity deficiency analyses and a description of the freeways, major thoroughfares, and minor thoroughfares that make up the Princeton Thoroughfare Plan.

Major Thoroughfares

Major thoroughfares carry high volumes of traffic within and through an urban area. Access along these facilities varies from limited access to no control of access. Access to these roads should be provided by use of minor thoroughfares or local streets whenever possible.

US 70

US 70 is a four-lane grass median divided facility. It serves as the major east-west through facility in Princeton. It connects Goldsboro to Johnston County and Wake County. Most of the traffic on this facility are passing through Princeton on route to their destination. There is a high amount of truck traffic on this facility. In is anticipated that the volume will be 50,000 vpd in the year 2025, which means it is at/above capacity. It is recommended that this facility be six lanes in the future and that it be made a controlled access facility(only access is through interchanges).

US 70 Business

This facility varies in cross-section through Princeton. It functions as the major east-west travel corridor in the downtown area of Princeton. The primary function is for local traffic in the Town. No improvements are recommended.

Pine St (SR 1002)

Pine Street is a two-lane facility that functions as the main north-south radial carrying traffic into the Princeton area. This is the main access off of US 70 into Princeton. The only schools in Princeton are located off of this facility and this creates a heavy traffic and pedestrian demand. It is recommended that the section from the Little River to US 70 be widened to 12 foot lanes and the section from US 70 to Railroad Avenue be widened to 3-lanes. The 3-lane section will allow for ease of turning into/out of the school and the housing that borders this facility. It is also recommended that sidewalks be a part of this improvement because of the high level of pedestrian activity.

Pearl Street (SR 2372)
This facility varies in cross-section throughout the town. It serves through traffic and performs as both a radial and a local collector. It has a higher percentage of trucks because of the direct route through town from the rock quarry. No improvements are recommended.

Pierce Street (SR 2535)
This 2 lane radial facility does not carry heavy amount of traffic and therefore has no future recommended improvements.

Old Rock Quarry Road (SR 2316)
SR 2316 is a two lane (9' lanes) radial facility that serves the outskirts of Princeton. The new residential is located in this area. The facility should be widened to 12' lanes.

Old Cornwallis Road (SR 2371)
This facility serves as a 2 lane (9' lanes) cross town route and has no improvement recommendations.

Holts Mill Pond Road (SR 2531)
This radial facility is currently a two-lane section having 1600 vpd. There are no future improvements necessary.

Minor Thoroughfares
Minor Thoroughfares collect traffic from local access streets and carry it to major thoroughfares. The following roads are classified as minor collectors. There are no recommended improvements necessary for these facilities to accommodate future traffic; however, as a safety measure, any of the following two-lane facilities with pavement width less than 20-feet should be considered for widening to 24-foot pavement width:

Pine Street(from Third St. to new Ballpark Road)
Center Street
James Street
Railroad Avenue

Pine Street and New Ballpark Road are not paved completely at the current time. It is recommended that both of these facilities be two-lane 24' paved sections. All of the improvement recommendations are shown in Figure 3.

Local Streets

Local streets are all roads that are not classified as a freeway, a major collector, or a minor collector. The primary function of local streets is to provide access to abutting property. These facilities are often residential, industrial, or commercial. The only new facilities recommended on the Princeton Thoroughfare Plan are the extension of Center Street to New Ballpark Road and the connection of Linda St. to Pool St. and US 70 Business to Lee Street. Both of these are local streets.

LEGEND

	Widening	New Facility
2 Lane		
3 Lane		
6 Lane		

Intersection Improvement

February 16, 1998

Figure 3

RECOMMENDED IMPROVEMENTS

PRINCETON

JOHNSTON COUNTY
NORTH CAROLINA

PREPARED BY

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 0.5 1
Kilometers

800 0 800 1600 2400
Feet

Construction Priorities, User Benefits, and Cost Estimates

The recommended improvements for the Princeton Thoroughfare Plan, as shown in Figure 3, cannot be undertaken all at once, nor should they be. The need for improvements is determined based on traffic projections for the 2025 design year, and these improvements should be progressively developed over the planning period. Therefore, improvement projects must be prioritized in order of importance to the Town in order to accomplish realistic scheduling. In an effort to provide a common denominator with which to compare the recommendations of the Princeton Thoroughfare Plan, an assessment of the benefits expected from implementing each of these improvements was made. These benefits and associated costs of improvements were then utilized along with local input as a guide in prioritizing projects.

Three principal measures were established to estimate the benefits derived from each improvement: road user cost savings; potential for increased economic development resulting from the improvement; and the positive and negative environmental impacts which may result. Road user cost savings is an actual estimate of monetary savings, while the other two measures are merely estimates of the probability of the resulting change.

Reduced road user costs should result from roadway improvements, such as a simple widening of the road or construction of a new roadway. For each recommendation, the existing and proposed facilities were compared based on vehicle operating costs, travel time costs, and accident costs. These user benefits were computed as total dollar savings over the thirty year design period, using data such at project length, base year and design year traffic volumes, traffic speed, facility type, and volume-to-capacity ratio.

The impact of a project on economic development potential is denoted as the probability that the improvement will stimulate the economic development of an area by providing access to land with development potential and reducing transportation costs. This subjective estimate was based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability was rated on a scale from 0.00 (none) to 1.00 (excellent). Table 1 presents the probability estimation guide that was used for the benefit analysis.

TABLE 1. PROBABILITY ESTIMATION GUIDE

Subjective Evaluation	Impact Probability
Excellent - very substantial	1.00
Very Good - substantial	0.75
Good - considerable	0.50
Fair - some	0.25
Poor - none	0.00

The environmental impact analysis considered the effect of improvement projects on the physical, social and cultural, and economic environmental. Many of these effects were included in the evaluation of the project with respect to user benefits, costs, and economic development potential; however, thirteen additional environmental factors were considered. These additional factors are as follows: air quality, water resources, soil and geology, wildlife, vegetation, neighborhoods, noise, educational facilities, churches, parks and recreational facilities, historic sites and landmarks, and aesthetics. The compilation of the positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impact of a project. Table 2 lists all of the environmental considerations that were analyzed during the development of the Princeton Thoroughfare Plan. Some of these environmental issues are discussed in Chapter VI of this report.

TABLE 2. ENVIRONMENTAL CONSIDERATIONS

Physical Soils and Geology	Social / Cultural Environment	Economic Environment
• Air Quality • Water Resources • Soils & Geology • Wildlife • Vegetation	• Housing & Neighborhoods • Noise • Educational Facilities • Churches • Parks & Recreational Facilities • Historic Sites & Landmarks • Public Health & Safety • National Defense • Aesthetics	• Businesses • Employment • Economic Development • Public Utilities • Transportation Costs • Capital Costs • Operation & Maintenance Costs

The benefits that may be derived from a roadway improvement project would be offset by the actual cost of constructing the facility. A new roadway may prove to be unjustified by the excessive construction costs, despite any projected benefits. The highway costs estimated in this report were based on the average statewide construction costs for similar type projects. In additional, anticipated right-of-way costs were also estimated. Table 3 presents the results of the user benefits, estimated costs, probability of economic development, and environmental impacts evaluation for each of the recommended improvements.

Table 3 - Benefits, Cost Estimates and Environmental Impacts								
Project	Length	Construction	ROW	Total	User	Economic	Environmental Impacts	
Name	(mi)	Cost	Cost	Cost	Benefits(Millions)	Dev. Pot	Positive	Negative
First Priority								
Widening of Pine Street (from US 70 to Railroad Avenue)	0.45	$806,200	$52,000	$858,200	$1.70	0.25	0.75	0.25
Second Priority								
Widening of US 70 (Wayne Co Line to Holts Pond)	3.00	$11,200,000	$350,000	$11,550,000	$226.00	0.5	0.5	0.25

III. IMPLEMENTATION

Implementing "the plan" that has been developed for the Town of Princeton is a challenging, but necessary part of the planning process. After all, if we do not try and build the new roads or improve intersections, then there is really no need in developing the thoroughfare plan. As discussed in Chapter 1 of the report, planning is a continuous process that is only successful if corridors are protected, development is controlled and funding is obtained in order to fulfill the needs identified on the plan.

The primary function of the Town of Princeton's thoroughfare plan is to provide guidance to the governing bodies of the Town in developing its highway system. It is the responsibility of the Town to provide citizens with the most effective transportation system possible by utilizing the legislative powers that are granted to the Town of Princeton and by maximizing all the resources that may be available. Due to the increase in construction costs and a low amount of revenue available for highway projects, problems in meeting the highway funding needs of smaller towns is increasing. There are not sufficient funds in the state or local government budgets to undertake all of the projects in an area and so the transportation plans are being scrutinized every day. By adopting this plan, the Town now has the right to protect the existing and proposed highway corridors through a wide variety of controls. It is important that the Town of Princeton be aware of the different "resources" that will help protect the roadway corridors and generate funding possibilities that will ensure the successful completion of the plan.

What are the tools that Princeton can use to implement our plan?

Below are the various tools that will aid the Town of Princeton in the protection of the corridors shown on the adopted thoroughfare plan. The description of each tool is followed by a "how to use this tool in Princeton" section. The Town should try and use each of these tools to their advantage when trying to implement "the plan".

State and Municipal Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina provides that after development of a Thoroughfare Plan, the Plan may be adopted by the governing body of the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the governing body of the municipality and Department of Transportation shall reach agreement on responsibilities for existing and proposed streets and highways included in the plan. Facilities which serve through traffic and traffic from outside the area to major business, industrial, governmental, and institutional destinations located inside the municipality are designated a State responsibility (These are the major thoroughfares or thick black lines in Figure #2). These types of facilities shall be constructed and maintained by the Division of Highways. Facilities which primarily serve internal travel are designated a municipal responsibility, and shall be constructed and maintained by the municipality (These are minor thoroughfares or the thin black lines in Figure #2). Once a thoroughfare plan is adopted, several other planning tools are available to assist plan implementation. Use of these controls and methods can help to maximize expenditure of funds and minimize land disruption.

How to use this tool in Princeton: Since the Town adopted the thoroughfare plan on May 4, 1998 and the N.C. Board of Transportation adopted the plan on June 5, 1998 the adoption tool has been used to the fullest extent. In the future, a systems agreement will need to be negotiated between the Town of Princeton and the Department of Transportation.

Subdivision Regulations

Subdivision regulations are locally adopted laws which govern how a developer may divide land into building sites. Each developer is required to submit a plat of the proposed subdivision to the municipality for approval before a building permit will be issued. Through this process, it is possible to reserve or protect the necessary right-of-way for streets which are a part of the thoroughfare plan and to require street construction in accordance with the plan. By requiring developers to construct subdivision roadways to minimum standards needed for the future proposed thoroughfare road, the maintenance costs are reduced and the transfer of streets to the State Highway System is simplified.

Appendix E of the outlines the recommended subdivision design standards as they pertain to road construction.

How to use this tool in Princeton: The Town of Princeton already has subdivision regulations. However, it may be important to look at the regulations to insure that the transportation system is not being adversely effected by the subdivision regulations (driveway procedures, street widths and required setbacks).

Roadway Corridor Official Map

North Carolina General Statutes 136-44.50 through 133-44.53 are collectively designated as the "Roadway Corridor Official Map Act". The roadway corridor official map, more commonly referred to as an official street map, is a document adopted by the legislative body of the community that pinpoints and preserves the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire certain specific property. The official map serves as a positive influence for sound development by reserving sites for public improvements in anticipation of actual need.

The NCDOT limits its use of official maps to large scale, fully controlled access facilities planned for developing areas outside of municipal jurisdictions. For projects within municipal jurisdictions, official maps should be prepared and adopted by the local government.

For cities contemplating the adoption of a Roadway Corridor Official Map, there are several issues to consider. First, it should be recognized that an Official Street Map designation places severe, but temporary, restrictions on private property rights. Issuance of building permits and/or the approval of subdivision plans within any property lying within an Official Street Map corridor are prohibited for up to three years. This three year prohibition period commences with the request for development approval. This authority should be used carefully and only in cases where less restrictive powers will be ineffective.

The Statute establishing the Official Street Map authority is fairly explicit in outlining the procedures to be followed and the types of projects to be considered. As required by the Statute, a project being considered for an Official Street Map must be programmed in the State Transportation Improvement Program (TIP) or included in a locally adopted Capital Improvements Program in addition to appearing on the adopted street system plan. The Statute states that the Capital Improvements Program must be for a period of ten years or less and must identify the estimated cost of acquisition and construction of the proposed project as well as the anticipated financing.

The Program and Policy Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Roadway Official Corridor Maps. Municipalities considering Official Street Map projects should contact this Branch for their "Guidelines for Municipalities Considering Adoption of Roadway Corridor Maps" at:

Program Development Branch , NC Department of Transportation
P. O. Box 25210
Raleigh, NC 27611

How to use this tool in Princeton: This particular tool cannot be used in Princeton at the current time because none of the prioritized projects have been listed as funded in the State Transportation Improvement Program (book that tells when funded projects throughout the state will be completed, discussed later in this chapter). However, if Princeton does get a project

funded in the future, this may be the time for the Town to try and use this type of enforcing tool to protect the corridor for the new roadway. This tool should only be used by the Town if other methods are not successful in protecting the corridor.

Zoning Ordinances

A zoning ordinance can be beneficial to thoroughfare planning by designating appropriate locations of various land uses and allowable densities of residential development. This provides a degree of stability by which future traffic projections can be made so that streets and highways can be planned.

Other benefits of a good zoning ordinance include the establishment of development standards. The standards aid traffic operations on major thoroughfares and minimize strip commercial developments that create traffic friction and increase the traffic accident potential.

How to use this tool in Princeton: The Town of Princetion may want to look at their current ordinances and make sure that they compliment the recently adopted thoroughfare plan. For example: at the major intersections it may be necessary to change from R-2 to a commercial zoning,C-2, at these locations, in order to attract more development.

Development Reviews

Driveway access to a state-maintained street or highway is reviewed by the District Engineer's office prior to access being permitted. Any development expected to generate large volumes of traffic (i.e. shopping centers, fast food establishments, larger industries, etc.) may be comprehensively studied by staff from the Traffic Engineering, Statewide Planning, and Roadway Design Branches of NCDOT. If completed at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for the developer, it is important that the municipality advise them of this review requirement and cooperate in the review process.

How to use this tool in Princeton: The Town of Princeton should make sure that any new development plans, such as grocery store be reviewed by the district engineers before giving them approval. Careful consideration needs to be given for driveway locations or access points of these new developments to insure that the proposed or existing roadways will operate efficiently. If developments are located near a proposed roadway improvement then the Town should talk with the owner/developer to see if right-of-way could be donated or reserved. The development review process is an opportune time for the Town to get land reserved or donated, thus ultimately reducing the roadway costs and improving the traffic flow in the future.

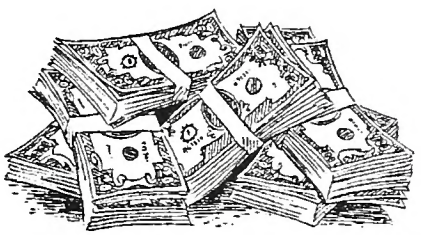
Urban Renewal

Urban renewal is defined as the rehabilitation of city areas by demolishing, remodeling, or rehabilitation of existing structures in accordance with comprehensive plans. This process allows for corrections to basic problems in the street system layout and design.

To qualify for community development funds or discretionary funds for urban renewal, a municipality must first prepare a community development program. Urban areas compete throughout the State on the basis of demographic points which consider such conditions as percent of substandard housing, people per square feet of housing, dwelling age, etc. An effort should be made to ensure that community development and transportation plans are compatible.

How to use this tool in Princeton: This tool will probably not be something the Town will consider because of the hometown atmosphere that currently exists. The layout of the downtown area is cherished by the community and it is important that the old buildings remain a fixture in this Town.

Funding Programs



Capital Improvement Program

One of the tools which makes it easier to build a planned thoroughfare system is a Capital Improvements Program. This is a long range budget for street improvements, acquisition of right-of-way, and other capital improvements on the basis of projected revenues. Municipal funds should be available for construction of street improvements which are a municipal responsibility, right-of-way cost sharing on facilities designated a Division of Highways responsibility, and advance purchase of right-of-way where such action is required. The program consists of two lists of projects: the projects to be funded and implemented fully by the municipality and a list of projects designated as a State responsibility and funded in the Transportation Improvement Program.

How to use this tool in Princeton: The Town should develop these two lists based on the thoroughfare plan and the other capital projects that the Town would like to see accomplished in the next ten years. Also a timetable as to how much money each year is put into each project. Since the Town has already prioritized the roadway projects from the thoroughfare plan then it will be easy to establish which projects should be on which lists. Table #4 is an example of what the Town of Princeton's program might look like.

Table 4 - Example of Capital Improvement Program

Capital Improvement Item	Want Funded by Year	TIP Project Item
1. Extend Water & Sewer	1999	1. NC 16 Widening
2. Widen SR 1111 (Providence Road in front of the school)	2000	2. Howie Parkway
3. Install Metal Posted Streetlights	2001	
4. Improve NC 16 & NC 75 Intersection	2001	

Transportation Improvement Program (TIP)

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects to be undertaken by the Department of Transportation for the next seven years. TIP projects are matched with projected funding sources. Every two years when the TIP is updated, completed projects are removed, programmed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests for a particular area of the state. Based on the technical feasibility, need, and available finding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacements projects, highway safety projects, public transit projects, railroad projects, and bicycle projects.

How to use this tool in Princeton: The Town should actively pursue this funding every year that the TIP is updated. The Town must present a logical explanation as to why this project should be funded and present it in a neat and orderly fashion to the Board Member. The packet that was created this past year is a good example for the Town to present to the board member. Appendix B shows the process for which the Town of Princeton should go through when requesting funding from the Department of Transportation.

Industrial Access Fund

If an industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, the funds may be made available for construction of an access road. For further information regarding this fund, inquiries should be directed to the NC Department of Transportation Secondary Roads Office.

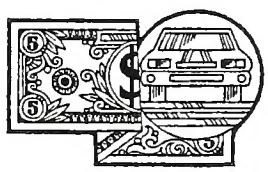
Small Urban Funds

Small Urban Funds are annual discretionary funds for each of the fourteen divisions of the state. Each division receives one million dollars per year for Board members to fund projects at their discretion. These funds are for the construction of projects occurring within city limits or at least within one mile of the municipal boundaries. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer. Once the Division Engineer and Board Member decide on which projects to fund in the division, then the Small Urban Committee gives final approval for the funding of the projects in the division.

How to use this tool in Princeton: This is a good tool for Princeton to use to get the right turn lane added at the Pine Street and US 70 intersection. Turn lanes need to be added at this location, since this is not a major project with a high cost the Town should present the information concerning this intersection to the Division Engineer and ask that the intersection be reviewed and improved using Small Urban Funds.

Other Funding Sources

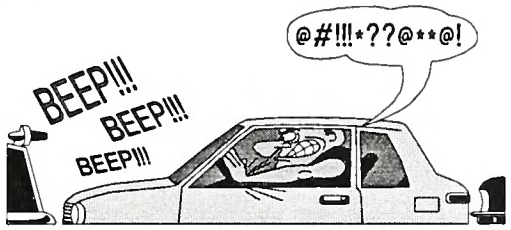
1. Enact a bond issue to fund street improvements.
2. Consider the possibility of specific projects qualifying for federal demonstration project funds.



3. Adopt a collector street plan that would assess buyer or property owners for street improvement.

The Town of Princeton has a lot of options that can be explored, both for protecting corridors and obtaining funding for the projects on the thoroughfare plan. The responsibility is up to the Town, to take the initiative to create more revenue through creative endeavors, to upgrade the transportation network and to provide the citizens with a well planned and established community. If the Town exercises the options that are available, then all of these goals will be accomplished.

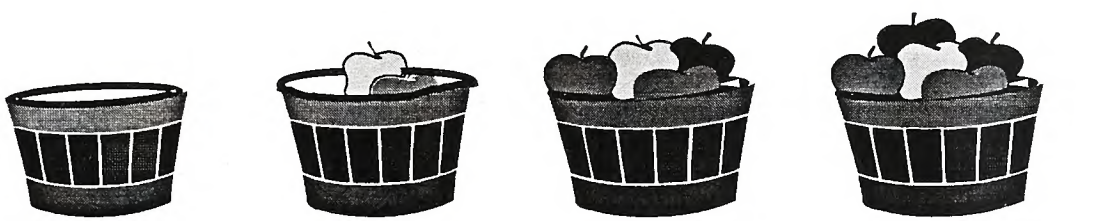
IV. TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM



This chapter presents an analysis of the existing street system and its ability to accommodate the travel desires found within the planning area. Emphasis is placed not only on detecting the deficiencies, but also on understanding their causes. Travel deficiencies may be localized, resulting from substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be the result of a system deficiency, such as a need for the construction of missing links. By analyzing travel deficiencies, proposed improvements can be recommended to alleviate these deficiencies.

Capacity Deficiencies

In an urban area, a street's ability to move traffic is generally affected by the spacing of major intersections, access control, width of pavement, and traffic control devices, such as signs and traffic signals. Before the thoroughfare plan was developed for the Town of Princeton, we determines what traffic problems existed presently or in the future. The computer model aids in this evaluation by showing us the traffic volume, or number of vehicles, using each road in Princeton on a daily basis. We can then compare the capacity (the number of vehicles that can travel on the road and still experience efficient travel) of each section to the number of vehicles actually using the road. If the number of vehicles using the road is almost the same or more than the number it can efficiently handle, otherwise known as the volume/capacity ratio, then we have a transportation problem, or roadway deficiency. The following cartoon illustrates the concept of volume/capacity ratio (V/C).



Empty Basket
Can Hold 5 Apples

Volume = 0 apples
Capacity = 5 apples
V/C ratio = 0

No Problems!!

2 Apples in Basket
Still Room for More!!

Volume = 2 apples
Capacity = 5 apples
V/C ratio = .4

No Problems!!

4 Apples in Basket
Near Capacity of Basket
Some difficulty getting more in the basket!

Volume = 4 apples
Capacity = 5 apples
V/C ratio = .8

Slightly Difficult to Get More Apples In!

5 Apples in Basket
Capacity of Basket is Met
No More will Fit Comfortably!

Volume = 5 apples
Capacity = 5 apples
V/C ratio = 1.0

Definite Problems
Another basket or a bigger one is needed to continue !

The relationship of traffic volumes to the capacity of the roadway determines the level-of-service (LOS) of that roadway. There are six levels of service used in identifying a range of possible conditions. These six levels of service, as presented in Figure 4, are described as follows:

LOS A: represents free traffic flow; individual users are virtually unaffected by the presence of others in the traffic stream; freedom to select desired speeds and maneuver within the traffic stream is extremely high.

LOS B: represents reasonably free traffic flow; the presence of other users in the traffic stream becomes noticeable; freedom to select desired speeds is relatively unaffected, but there is a slight decline in the ability to maneuver.

LOS C: represents stable traffic flow, but marks the beginning of when small traffic increases will cause substantial deterioration in service; freedom to maneuver is noticeably restricted; minor incidences may still be absorbed, but decline in service is high.

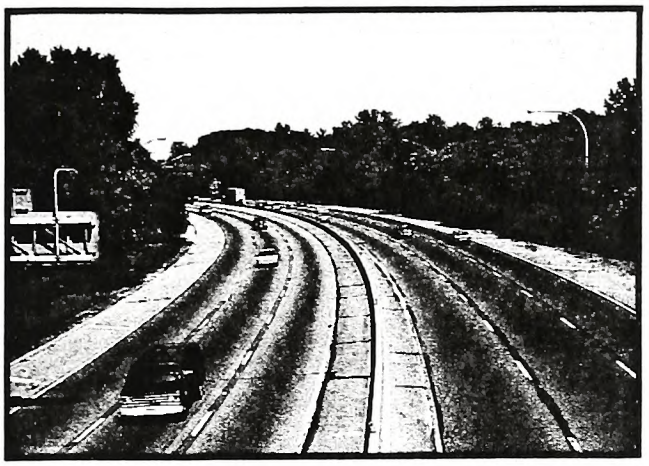
LOS D: represents high-density traffic bordering on unstable flow; small increases in traffic flow will cause substantial deterioration in service; freedom to maneuver is limited and driver experiences discomfort; minor incidents create substantial queuing.

LOS E: represents operating conditions at or near the capacity level of the facility; speeds are reduced to a low, but relatively uniform value; maneuverability within the traffic stream is extremely difficult and generally accomplished by a vehicle or pedestrian to "give way" to accommodate such a maneuver.

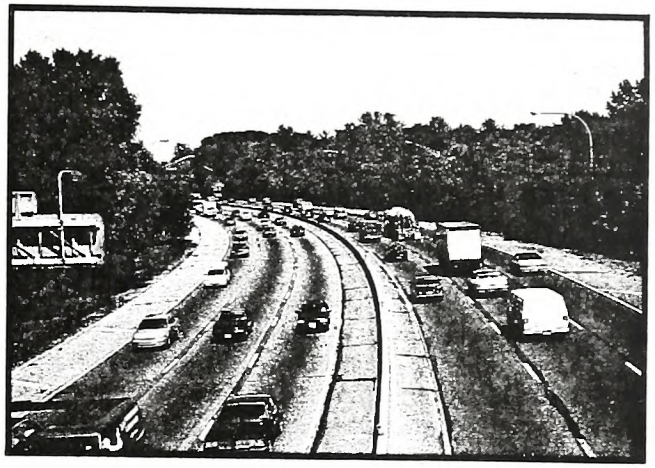
LOS F: represents forced or breakdown traffic flow; this exists when the amount of traffic approaching a point exceeds the amount of traffic that can traverse that point, resulting in the formation of queues; operating conditions within these queues are characterized by stop-and-go waves that are extremely unstable.

Design requirements for thoroughfares vary according to the desired capacity and level of service. Each facility must be individually analyzed and its design requirements determined based on the amount of projected traffic, existing capacity, desired level of service, and available right-of-way. The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing facilities and LOS C on new facilities. LOS D is considered the "practical capacity" of a facility, or that at which the public begins to express dissatisfaction.

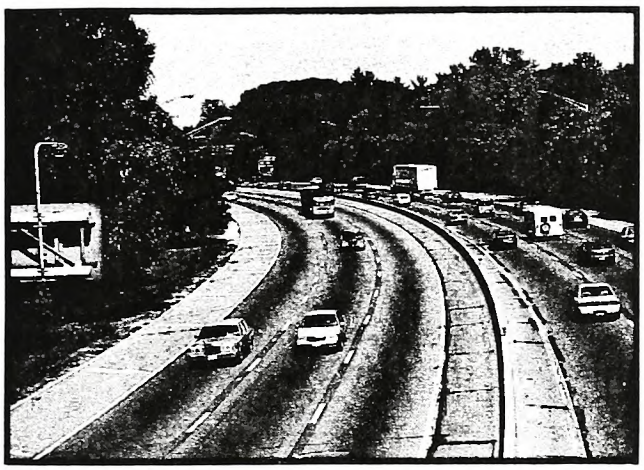
Source: 1994 Highway Capacity Manual



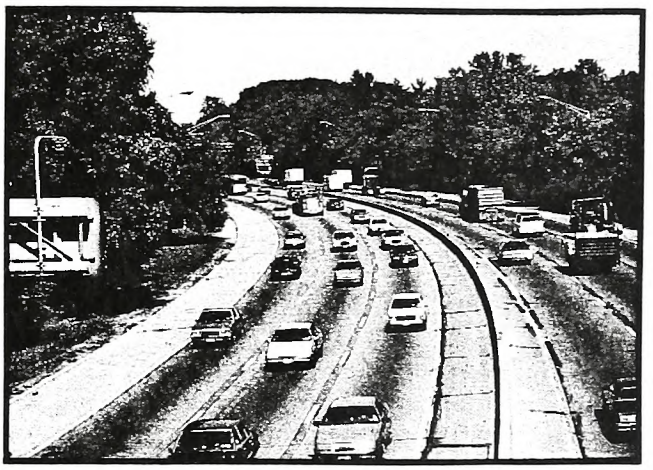
LOS A.



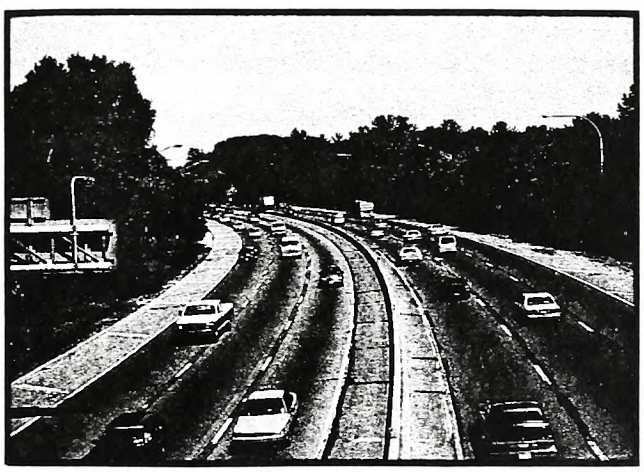
LOS D.



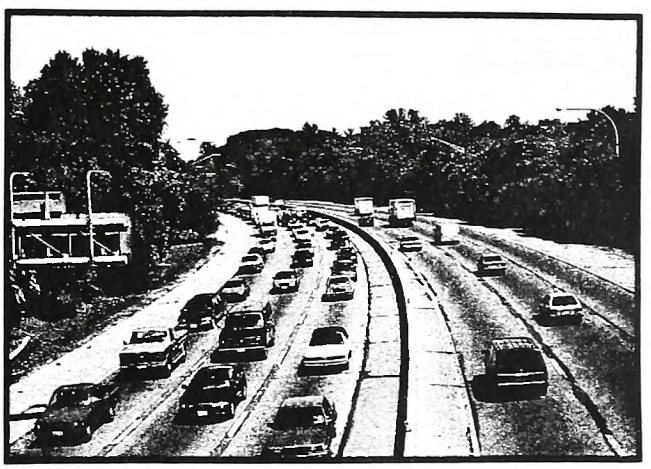
LOS B.



LOS E.



LOS C.



LOS F.

Figure 4 LEVELS OF SERVICE

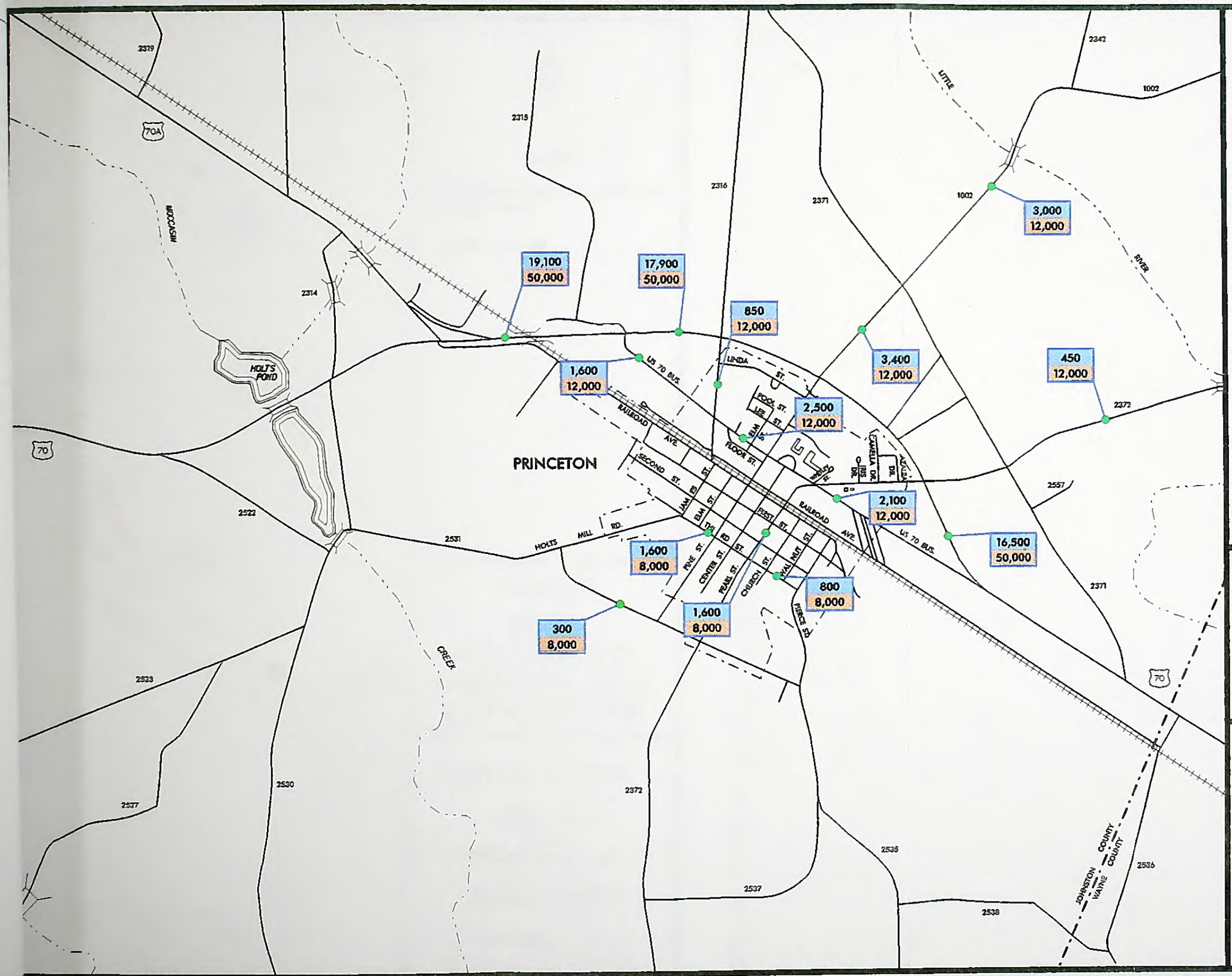
1995 Traffic Capacity Analysis

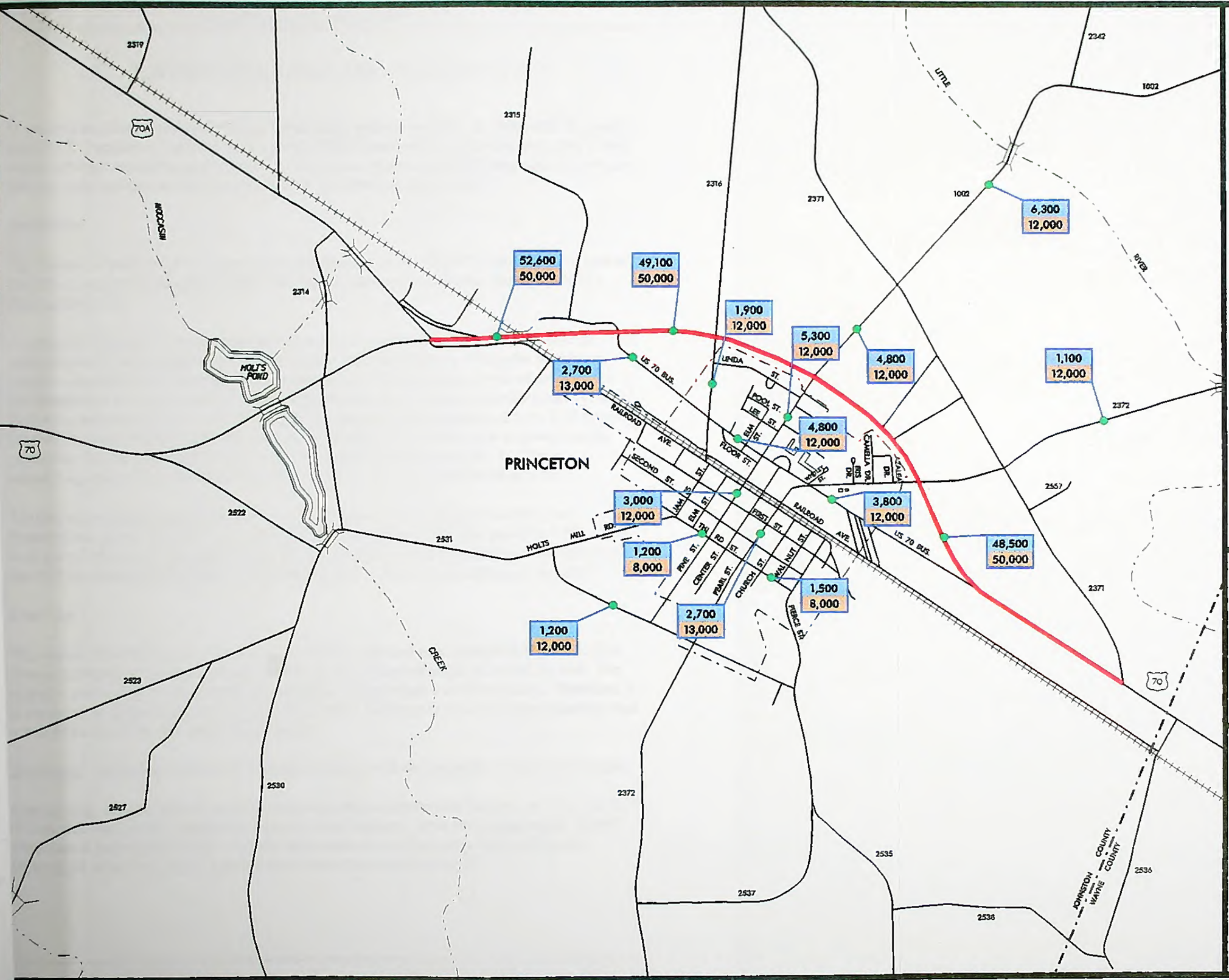
The NCDOT conducts annual traffic counts across the state. These counts are reported as Annual Average Daily Traffic (AADT) volumes. The comparison of current AADT volumes with current practical capacities for the roadways in the planning area is shown in Figure 5. This information was utilized in analyzing the base year capacity deficiencies. This analysis indicated that all of the studied roads within the planning area are currently under capacity.

2025 Traffic Capacity Analysis

The capacity deficiency analysis for the 2025 design year is based upon the "no build" alternative. Meaning, no new roads or improvements are done in the next 25 years. This analysis examined the existing street system and determined that US 70 is the only roadway within the planning area that will exceed practical capacity by the design year. Figure 6 shows the capacity deficiencies determined for the design year based on this analysis.

The improvement to US 70 recommended will alleviate the deficiency described above. The other improvements are to make the system a little more efficient but are not related directly to the in ability of the roadways to handle the amount of traffic that will exist on them.


LEGEND
00,000 1995 Average Daily Traffic Count
00,000 Capacity
19,100
50,000
17,900
50,000
850
12,000
1,600
12,000
3,000
12,000
3,400
12,000
450
12,000
2,500
12,000
2,100
12,000
16,500
50,000
1,600
8,000
800
8,000
1,600
8,000
300
8,000
PRINCETON
US 70 BUS.
RAILROAD AVE.
FLORA ST.
LINDA ST.
POOL ST.
LEE ST.
SIMS ST.
CAMELIA DR.
IRIS DR.
JULIA DR.
SHIRLEY DR.
SECOND ST.
ELM ST.
PINE ST.
CENTER ST.
PEARL ST.
CHURCH ST.
FIRST ST.
WALNUT ST.
FIERCE RD.
HOLTS MILL RD.
HOLTS POND
MOCCASIN CREEK
LITTLE RIVER
JOHNSTON COUNTY
WAYNE COUNTY
2319
2315
2316
2371
2342
1002
2314
2372
2557
2522
2531
2523
2530
2527
2372
2535
2537
2536
2538
70A
70
Figure 5
1995
VOLUME TO
CAPACITY
PRINCETON
JOHNSTON COUNTY
NORTH CAROLINA
PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
0 0.5 1
Kilometers
800 0 800 1600 2400
Feet



LEGEND

00,000 2025 Average Daily Traffic Count
00,000 Capacity

At Capacity

Figure 6

2025 VOLUME TO CAPACITY AND DEFICIENCIES

PRINCETON

JOHNSTON COUNTY
NORTH CAROLINA

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FEDERAL HIGHWAY ADMINISTRATION

0 0.5 1
kilometers

800 0 800 1600 2400
feet

V. POPULATION, LAND USE, AND ECONOMY

In order to develop a thoroughfare plan, future travel patterns must be determined for the design year 2025. Population, land use, and economy effect travel patterns, therefore, they play a vital role in determining the transportation needs of a town. Examining these factors can help explain historic travel patterns and lay the groundwork for predicting future travel.

Population

The volume of traffic on a road is related to the size and distribution of the population it serves. Therefore, analysis of population data offers useful information to aid the development of a thoroughfare plan.

A survey of housing and employment information was conducted in order to determine the 1995 socio-economic data required for traffic analysis of the planning area. Using the population trends as a control factor, the planning area population (includes areas outside of town limits) was determined by applying an occupancy factor to the actual number of dwelling units counted. Following past trends, the occupancy rate for the design year was determined to be 2.35 persons per dwelling unit. Furthermore, the modeling procedure used for this study required that the population data be converted into the number of actual dwelling units (DU's). These calculations resulted in a 1995 base year population of 2,040 with 868 dwelling units.

The future population was calculated by using past growth trends in the Princeton area. Princeton has grown at .62% since 1970, while the county as a whole has grown at 1.4% . This slow rate of growth for Princeton is expected to continue over the next 30 years and therefore the 2025 planning area population is estimated at 2442 with 1039 total houses in the area.

Land Use

The amount of traffic on a particular road is related to the land uses adjacent to that road. The type and intensity of the land use has an effect on the amount of traffic on a road, as well. For example, a shopping center generates larger traffic volumes than a residential area. Therefore, it is important to differentiate between land uses. When dealing with transportation planning, land use is divided into the following classifications:

Residential: all land devoted to the housing or people, with the exception of hotels and motels;

Commercial: all land devoted to retail trade, including consumer and business services and their offices; this breakdown includes two separate classifications: retail and special retail. Special retail would include high-traffic establishments, such as fast-food restaurants and service stations; all other commercial establishments would be considered retail;

Industrial: all land devoted to manufacturing, storage, warehousing, and transportation of products;

Public: all land devoted to social, religious, educational, cultural, and political activities; this would include the office and services employment classifications.

The Princeton Planning Area consists of all four types of land use. Commercial development is predominate in the downtown area , as well as along the US 70 corridor. The majority of the remaining land use within the town limits is residential and some public (schools and government offices). The Rock Quarry and the Pole Stripping Companies located outside of the Town Limits are the main industries.

The anticipated future land use development for the Planning Area is mostly residential and commercial. Residential growth is expected around the New Ballpark Road area (Zones 34,17,18), Old Rock Quarry Road (Zone 23), and a trailer park is anticipated along N. Railroad Avenue (Zone 16) outside the town limits. Commercial development is expected on the corner of US 70 and Pearl Street (SR 2372) in Zone 26. A grocery store and some small strip mall shops will most likely inhibit this area. A small medical facility and general commercial growth is expected in Princeton. Figure 7 shows the zones for the Princeton Planning Area.

Economic Trends

Travel patterns in an area reflect the economic environment. Employment was used as an indicator of economic activity for the Princeton Planning Area. Table 7 presents employment data for the 1995 base year and the projected employment for the 2025 design year. The 2025 employment figures are based on the current employment trend with a higher increase in the number of retail and office type employment. A summary of employment by zone is included in Appendix A.

TABLE 5 - EMPLOYMENT FOR PRINCETON PLANNING AREA

	1995	*2025*
Total Employment	**684**	**818**
Industry	179	192
Retail	144	191
Special Retail	53	75
Office	217	247
Services	91	113

Figure 7

ZONE MAP

PRINCETON

JOHNSTON COUNTY
NORTH CAROLINA

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0 0.5 1
kilometers

800 0 800 1600 2400
feet

VI. ENVIRONMENTAL CONCERNS

In the past several years, environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act (NEPA). Section 102 of the act requires the execution of an Environmental Impact Statement (EIS), for road projects that have a "significant impact" on the environment. Included in the EIS are the project's impacts on the physical environment, the social and cultural environment, and the economic environment. Table 2 lists these environmental considerations in more detail.

This report does not cover the environmental considerations in as much detail as an EIS does, however, consideration for many of these factors was incorporated in developing this Thoroughfare Plan. These factors were also utilized in evaluating the recommended improvements during the benefit-cost analysis, presented in Chapter II of this report.

Environmental Impacts of Recommended Improvements

There are only two major projects in the Princeton area that would be concerned with environmental impacts: the widening of US 70 and the widening of Pine Street. The other projects are just to bring existing roadways up to standards (ie...widening to 12' lanes and paving soil roads).

The environmental impacts of these two projects are described in Table 4. There are very limited impacts as a result of these two projects.

Table 6 - Environmental Impacts for Thoroughfare Plan Projects

Category	US 70 Widening	Pine Street Widening
Length (Miles)	3.0	.45
(Kilometers)	4.84	.73
Wetlands (acres)	0	0
Protected/Critical Watershed (acres)	0	0
High Quality Water Zones (acres)	0	0
Nurseries/Spawning Areas	0	0
Hydrologic Crossings		
Normal	2	1
Trout	0	0
Critical Habitats	0	0
Special Natural Areas	0	0
National Heritage Occurances	0	0
Historic Sites (NR & Candidate)	0	0
Historic Districts	0	0
Archaelogical Sites/Areas	0	0
Cultural Resources:		
Schools	0	0
Parks/Community Facilities	0	0
Churches	0	0
Cemetaries	0	0
Subdivisions	0	
Superfund Sites/Landfills	0	0
Groundwater Incidents	0	0
NPDES Dischargers	0	0
Non-discharge systems	0	0

* The numbers for this portion of the bypass are based on the preferred alignment

** Widening of NC 16 is 1.44 miles to 5 lanes & .49 miles to 3 lanes

Wetlands

Wetlands are those lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plan and animal communities living in the soil. Wetlands are crucial ecosystems in our environment. They help to regulate and maintain the hydrology of rivers, lakes, and streams by slowly storing and releasing flood waters. Wetlands help maintain the quality of water by storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations. Wetlands provide an important

habitat for approximately one-third of the plant and animal species that are federally listed as threatened or endangered.

Minimal wetland impacts should result from the recommended improvements. However, more extensive investigations shall be required prior to the design of any recommended facility.

Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973 allows the U.S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a roadway project on endangered plants and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, it is possible to avoid or minimize these impacts.

A preliminary review of the Federally Listed Threatened and Endangered Species in the Princeton area was completed to determine what effects the recommended improvements could have on wildlife. Mapping from the North Carolina Department of Environment, Health, and Natural Resources showed that no threatened or endangered species are present within the Princeton Planning Area. However, prior to the construction of any roadway improvement project, a detailed field investigation for threatened and endangered species is recommended.

Historic Sites

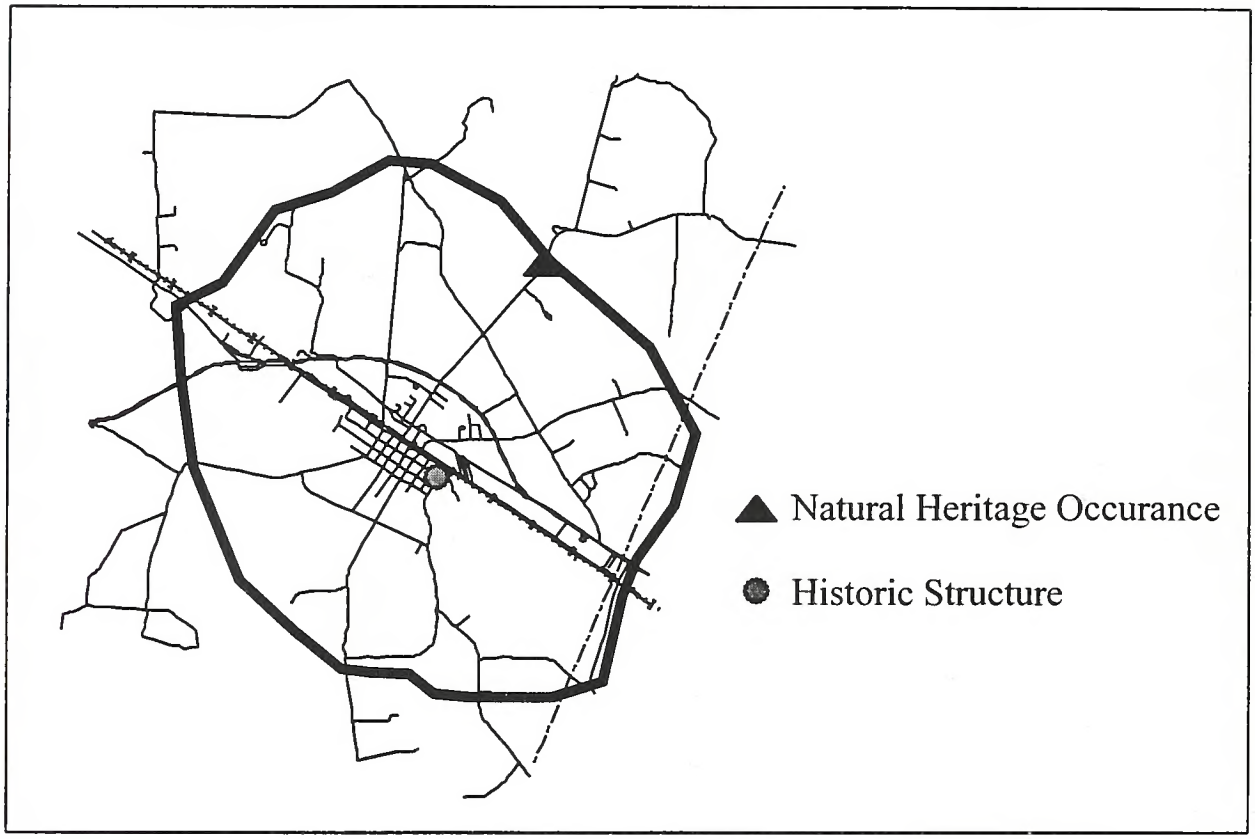
The locations of historic sites within the Princeton area were investigated to determine the possible impacts of the various recommended improvements. The federal government has issued guidelines requiring all State Transportation Departments to make every effort to preserve historic sites. In addition, the State of North Carolina has issued its own legislation, which is described as follows:

National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties that are eligible to be listed on the register. DOT must consider the impacts of its road projects on these properties and consult with the Federal Advisory Council on Historic Preservation.

NC General Statute 121-12(a) - This statute requires NCDOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. NCDOT must consider impacts and consult with the North Carolina Historical Commission, but is not bound by their recommendations.

After researching historic information in the Princeton area, it was determined that a few historic structures are located within the planning area. However, none of these structures will be effected by the improvements recommended for the Princeton area. Figure 8 shows the historic sites in the Princeton planning area.

Figure 8 -Historic Sites in Princeton



Archaeological Impacts

The location of recorded archaeological sites was researched to determine the possible impacts of proposed roadway projects. Based upon this initial investigation, no archaeological sites should be impacted by any of the recommended improvements. However, archaeological sites are often difficult to identify without actual field excavation. As a result, possible sites may not be identified during the initial planning process; therefore, each proposed project should be evaluated individually prior to construction.

Housing and Neighborhoods

The preservation of cohesive neighborhoods is a fundamental aspect of thoroughfare planning. When specific streets are designated as thoroughfares heavy traffic is minimized on neighborhood streets, thereby minimizing negative impacts. In order to reduce heavy traffic on residential roads, it is imperative that new facilities be constructed and/or existing facilities be improved. The

widening of Pine Street will not adversely affect the housing along the roadway because the current right-of-way should be efficient. The improvement to this facility will also improve the safety of turning motorists and pedestrians in the Princeton area.

Educational Facilities

The location of educational facilities in the Princeton Planning Area was considered during the development of the Thoroughfare Plan. No school will be displaced by any proposed facilities or widening, while implementation of the Thoroughfare Plan will actually have positive effects on educational facilities in the Princeton Area. The proposed widening of Pine Street will improve access and safety for Princeton High School and Elementary School.

Economic Environment

The development and implementation of the Princeton Thoroughfare Plan will have a positive affect on the economic development of the Princeton area. As new thoroughfares are constructed and existing ones widened, travel conditions will improve, resulting in a positive impact on the overall business climate.

VII. TRAFFIC MODEL DEVELOPMENT

The development of the Town of Princeton Thoroughfare Plan required that a traffic model of the planning area be developed. Several steps were completed in this development process. They are as follows:

- The planning area was defined;
- The base year (1995) network was developed;
- The trip generation characteristics were determined;
- The trips were distributed to the modeled network;
- The trips were assigned on the network and calibrated to ensure that the traffic model duplicated the existing travel patterns of the planning area.

Once the calibration of the 1995 base year traffic model was completed, the following steps were taken prior to the development of recommendations to alleviate system deficiencies:

- The socio-economic data was projected to the 2025 design year;
- The existing street system was analyzed for deficiencies using the future traffic;
- Alternate solutions to future capacity deficiencies were evaluated.

The Planning Area

The planning area for the Town of Princeton encompasses all of the town limits, as well as the surrounding area that is anticipated to become urban by the 2025 design year. The planning area has been divided into two sections using an east-west screenline. This screenline was later put to use in the model calibration process. The planning area was further divided into thirty-four travel analysis zones of similar land use. The planning area and traffic analysis zones are shown in Figure 7.

The Base Year Network

The purpose of the traffic model is to duplicate the prevailing conditions of the existing street system. Therefore, an initial decision that was made was the determination of the streets which would be used to define the base year model. A balance exists between having too many streets modeled to allow for calibration and not including adequate streets to realistically duplicate existing conditions.

There were numerous criteria used to select the base year network. First, good engineering judgment based on a general knowledge of the study area was used. Second, the base network included all of the streets that carry a substantial amount of traffic. Finally, major and minor thoroughfares were included, as well as some of the local streets. Local streets, however, are not generally included because they are normally simulated by connections between zone centroids

and modeled streets. The 1995 base year network chosen for the Town of Princeton Planning Area is shown in Figure 9.

Speed and distance were input factors used in coding the base network. These factors are significant since they define the minimum time paths between zones. These minimum time paths were then used in the model as the basis for assigning traffic to the streets in the system. Generally, in the Princeton model, the speeds assigned to the streets were at or slightly below the posed speed limit. This represented as closely as possible the actual speed of traffic traveling on the facility.

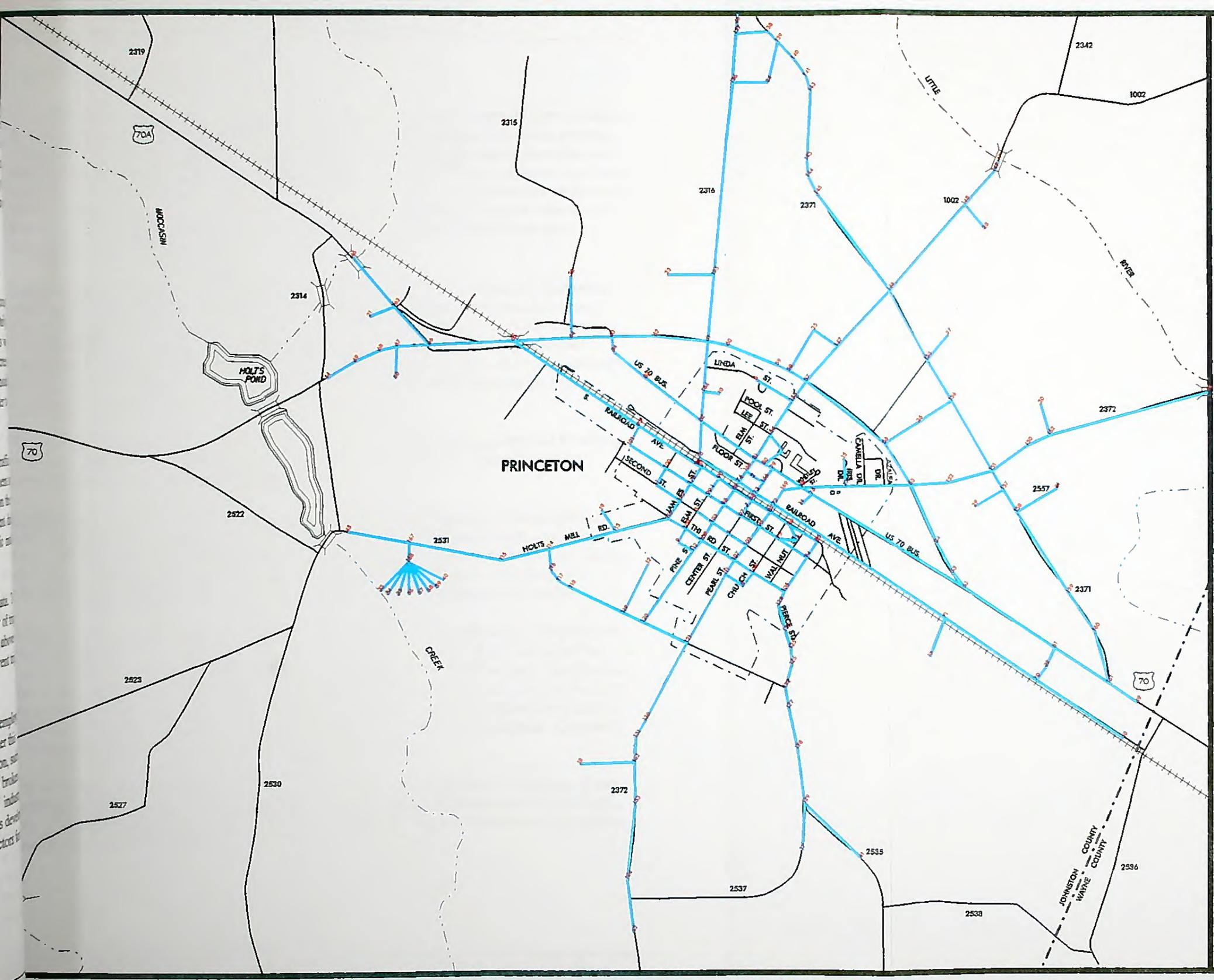
Data Requirements

Prior to developing the traffic model, two types of data were required. First, traffic counts on streets in the network were required as a basis for calibrating the model. Average Daily Traffic (ADT) counts were compiled at various locations throughout the study area. Counts were also taken at locations where streets crossed either the Planning Area Boundary or the screenline, and were then converted to ADT counts. These counts were then used to calibrate the model. Calibration is the process in which various factors are adjusted on the model in order to duplicate the existing traffic conditions as closely as possible.

Second, socio-economic data (housing and employment) was needed to generate traffic on the model. The socio-economic data consists of a housing inventory and an employment survey of the entire survey area. The housing data was used in the model to generate trips on the network. The employment data was used to attract those trips. The housing and employment data for each zone was broken down into specific classifications for use in developing the traffic model. The housing and employment information for each zone is given in Appendix A.

A windshield survey of the planning area was conducted to collect the housing data. The type and quality of housing was used as an indicator representing the average number of trips made from a household in a day. The housing data was divided into three categories: above average, average, and below average. Each of these categories was then assigned a different trip generation rate.

A listing of employers for the Johnston County area was used to determine the employers located within the planning area. A windshield survey was also conducted to help gather this information. Employers were then contacted to obtain more specific information, such as the number of persons employed by that business. The employment data was then broken down by Standard Industrial Code (SIC) classification and grouped into five categories: industry, retail, special retail, office, and service. This data was used with regression equations developed from an origin and destination survey of a similar-sized town to obtain attraction factors for each zone.



LEGEND

Network Link

00 Network Node

Figure 9

NETWORK MAP

PRINCETON

JOHNSTON COUNTY
NORTH CAROLINA

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0 0.5 1
kilometers

800 0 800 1600 2400
feet

Trip Generation

Trip generation is defined as the relationship between trip making and household characteristics. This is the first phase of four basic phases in the traditional travel demand forecasting process. This is the process by which external station volumes, housing data, and employment data are used to generate traffic volumes. The technical definition of a trip is slightly different than what would be used by the general public. Technically, a trip has only one origin and one destination, while the public tends to group, or chain, several short trips together and consider them as one longer trip. Traffic inside the study area was analyzed based on three different trip types: through trips, internal trips, and external ←→ internal trips.

Through trips are produced outside the planning area and pass through in route to a destination which is also outside the planning area. The through trip table for this study was developed using SYNTH, a computer program developed by James T. McDonnell, P.E., of the Statewide Planning Branch. This program was based upon *Technical Report Number 3, Synthesized Through Trip Table for Small Urban Areas*, by David G. Modlin, Jr., Ph.D., P.E. This method of developing through trips is based on the fratar balancing method which balances the trip interchanges at the external stations.

The SYNTH program output was used in conjunction with engineering judgment and knowledge to derive the number of trip-ends passing through each external station. These through trip percentages vary depending on the function of the road.

Internal trips have both their origin and destination inside the planning area. Internal trips are further subdivided into three trip purposes: home-based work, home-based other, and non-home-based. These trips were calculated using the computer program Internal Data Summation (IDS), which was written by Mike Bruff, P.E., of the Statewide Planning Branch. This program calculated trip productions and trip attractions, which are then used in the gravity model.

Trip productions were produced by running the IDS program, which applied generation rates to the housing inventory for the planning area. Housing units were classified as a surrogate for income, which is used to account for varying trip generation rates. Therefore, each classification was assigned a different coefficient representative of the number of trips made per household for that particular category. The average trip generation rate for households in the planning area in 1995 was 5.78 trips per household. The State's average is 7 to 8 trips per household. Generation rates used for the Princeton study area can be found in Table 6.

Trip attractions were produced by running the IDS program using regression equations. These equations consider trip attractions to be related to the employment characteristics of each traffic zone. The equations used for the Princeton planning area were based on equations taken from a similar study and are as follows:

HBW (Home Based Work)

$$Y = 1.0\,X_1 + 1.0\,X_2 + 1.0\,X_3 + 1.0\,X_4 + 1.0\,X_5$$

HBO (Home Based Other)

$$Y = 0.1\,X_1 + 1.50\,X_2 + 4.40\,X_3 + 1.60\,X_4 + 1.100\,X_5 + 3.0\,X_6 + 0.30\,X_{12}$$

NHB (Non-Home Based)

$$Y = 0.2\,X_1 + 1.50\,X_2 + 4.40\,X_3 + 1.60\,X_4 + 1.100\,X_5 + 3.0\,X_6 + 0.10\,X_{12}$$

EXT (External ←→ Internal)

$$Y = 0.5\,X_1 + 1.50\,X_2 + 4.40\,X_3 + 1.60\,X_4 + 1.100\,X_5 + 3.0\,X_6 + 0.10\,X_{12}$$

Where:

Y	=	Attraction factor for each zone
X_1	=	Industry (SIC codes 1-49)
X_2	=	Retail (SIC codes 55, 58)
X_3	=	Special Retail (SIC codes 50-54, 56, 57, 59)
X_4	=	Office (SIC codes 60-67,91-97)
X_5	=	Services (SIC codes 70-76, 78-79, 99)
X_{12}	=	Attraction caused by total housing per zone

In addition to the previous trip purposes discussed, non-home based secondary trips (NHB_2) are included in the internal trip analysis. These trips are those made by cars initially garaged outside of the planning area that make additional trips once inside the planning area. For example, if a vehicle is garaged outside the planning area and makes a trip to work inside the planning area, then that is one external → internal trip. If that vehicle makes an additional trip during the day before making the trip home, that additional trip is a non-home based secondary trip. These trips were determined by the following equation:

$$NHB_2 = [\,(\text{Total Ext} \leftrightarrow \text{Int Trips}) - (\text{Int} \rightarrow \text{Ext Trips})\,] \times 0.45$$

$$1995\ \text{Secondary Trips} = (9682 - 743) \times 0.45 = 4022$$

In order to run IDS, percentages for different trip types and purposes were required. Internal trips that remained inside the planning area consisted of 85% of the total internally generated trips. This resulted in 15% internal → external trips, which are those trips generated internally and traveling outside the planning area. The 85% internally generated trips were further divided into three other trip types: HBW (25%), HBO (53%), and NHB (22%).

External ←→ Internal Trips have one end of the trip inside the planning area, with the other end located outside of the planning area. These trips are generated at the external station and are a component of the external station traffic count. These trips are made up of external → internal and internal → external trips (discussed previously). The trip volumes for external ←→ internal trips were determined by subtracting the through trip-ends at each external station.

Trip Distribution

Trip distribution is the second phase in the travel demand forecasting process. Once the number of trips per traffic zone was determined, the trips were then distributed to other traffic zones in the network. The preferred method of distributing trips and the one utilized in this study is using the Gravity Model. The Gravity Model is based on the concept that transportation demand between two zones is proportional to the size of the productions and attractions in all zones and is inversely related to the impedance between zones. The Gravity Model is determined by the following equation:

$$T_{ij} = P_i \times \frac{A_j \times F_{ij} \times K_{ij}}{\sum_{j=1}^{n} (A_j \times F_{ij} \times K_{ij})}$$

Where:
- T_{ij} = Number of trips produced in zone i and attracted to zone j
- P_i = Number of trips produced in zone i
- A_j = Number of trips attracted in zone j
- F_{ij} = Friction factor from zone i to zone j
- K_{ij} = Socio-economic adjustment factor
- n = Total number of zones
- i = Origin zone number
- j = Destination zone number

The travel time factor or friction factor is critical to the gravity model distribution. The friction factor is affected by the distance between the traffic zones and the time necessary to travel those distances. It is also related to the specific trip purposed: home based work, home based other, non-home based, and external ←→ internal.

For the Princeton study, friction factors were derived from those developed for a similar study. These friction factors were adjusted to reflect travel times for the study area for each trip purpose and input into the gravity model. The output from the gravity model method resulted in a average trip length for each trip purpose: home-based work trips averaged 3.642 minutes, home-based other trips averaged 3.386 minutes, non-home based trips averaged 3.225 minutes, and external ←→ internal trips averaged 3.426 minutes. These average trip lengths gave a check for reasonable input variables. Table 7 presents the values used for the friction factors.

TABLE 7 - FRICTION FACTORS				
Time Interval	**Friction Factors** (Trips Distributed)			
	HBW	HBO	NHB	E → I
1	11933	17686	6052	424858
2	88025	94868	41537	495127
3	62636	58552	40973	210698
4	11255	10159	13038	51267
5	1337	1210	3004	11169
6	275	242	1125	3411
7	256	198	1536	2287

Mode Choice

Mode choice is the third phase in the travel demand forecasting process, however, since there is no transit service present or planned in Princeton, this phase was not used. Mode choice is the process by which the amount of travel that will be made by each available mode choice is determined. Typically, the two major mode types analyzed are auto and transit. The major input for mode choice comes from the trip distribution model, which is the process that was just completed.

Trip Assignment

Trip assignment is the fourth phase in the travel demand forecasting process. The purpose behind a trip was determined in the trip generation phase; the origin and destination of that trip was defined in the trip distribution phase; and, finally, the route used to complete the trip is determined in the trip assignment phase.

The all-or-nothing method is the simplest form of loading and is best suited for use in uncongested areas. This method assigns all trips to routes with the shortest impedance between zones, assigning nothing to the remaining routes. The all-or-nothing method was used to load the Princeton model.

Model Calibration

The purpose of a traffic model is to forecast the traffic on a roadway system at some time in the future. Therefore, the model must duplicate the existing transportation system, as well as the existing traffic patterns. The actual calibration of a model is an iterative process that allows incremental changes to be made to the trip generation, trip distribution, or roadway network. Each change is an attempt to allow the model to more accurately reflect the travel patterns that exist on the roadway network. Once the modeled traffic replicates the existing traffic, the model may then be used to predict future traffic.

Accuracy Checks

Three steps may be taken to check the level of accuracy of the model. The first step follows the trips through all of the steps involved in developing the model, ensuring that no trips are accidentally added or subtracted and no trips are counted more than once.

The second step compares the trips generated from the model at the screenline with the actual ground counts taken along the screenline. If the trips that are generated by the model are within 90% to 110% of the ground counts taken at the screenline, then the model is accurately reflecting the overall travel patterns of the study area. The generated traffic volumes at the screenline for the Princeton network, as shown in Table 8, were 3% lower than the actual ground counts at this location.

Table 8 - Screenline Accuracy

North-South Screenline (Along Railroad Tracks)	
Volume Counted	24400
Model Volume	23652
% Difference	-3%
East-West Screenline (Along Pine Street)	
Volume Counted	22000
Model Volume	21472
% Difference	-2%

The final step in checking the model accuracy is matching traffic volumes on the links in the model with the ground counts at the same locations. This can also be used to locate specific problems that might be present in the network, and is useful during the calibration process.

Data Projections for the Design Year

Once the calibration of the base year model was completed, the design year projections for internal trips and external and through trips were determined. The anticipated design year traffic conditions were simulated using these projections in conjunction with the four-step process previously discussed.

Internal Trip Projections

Projections of the housing and employment data were required to estimate internal trips for the 2025 design year. Initial projections were determined based upon historical trends for both

Johnston County and the Town of Princeton. These initial projections were then presented to the local government for comments, and the resulting projections are presented in Appendix A.

The IDS computer program was run implementing the design year projections as the necessary input variables. This input data is presented in Table 9.

TABLE 9 - TRAVEL MODEL INPUT VARIABLES		
	1995	2025
Trip Percentages by Purpose		
Internal of Total	80%	80%
Home Based Work	25%	25%
Home Based Other	53%	53%
Non-Home Based	22%	22%
Persons / Household	2.54	2.54
Average Daily Trips / Household	5.78	5.83
Generation Rates for Housing		
Excellent	10.00	10.00
Above Average	8.00	8.00
Average	6.00	6.00
Below Average	5.00	5.00
Poor	4.00	4.00

External and Through Trip Projections

External and through trip projections for the 2025 design year were projected from the base year traffic using a linear projection of past growth rates along with knowledge of the area's development patterns. Table 10 shows the external ←→ internal and through trip-ends determined for this study, along with the corresponding traffic count at each station.

TABLE 10 - TRAVEL DATA SUMMARY		
Type of Travel	**1995**	**2025**
Through Trips	17534	50224
External ←→ Internal Trips	9682	21152
Internal Trips		
Home Based Work	1,038	1,250
Home Based Other	2,201	2,651
Non-Home Based	914	1,100
Non-Home Based Secondary Trips	4027	9,121

VIII. THOROUGHFARE PLANNING PRINCIPLES

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and is expensive to build and maintain, much care and foresight are required in its development. Thoroughfare planning is the process used by public officials to assure the development of the most appropriate street system to meet existing and future travel desires within the urban area.

The primary objective of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase. In addition, it will alleviate unnecessary improvements, thereby averting needless expense. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should include those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. providing for the orderly development of an adequate major street system as land development occurs;

2. reducing travel and transportation costs;

3. reducing the cost of major street improvements to the public through the coordination of the street system with private action;

4. enabling private interests to plan their actions, improvements, and development with full knowledge of public intent;

5. minimizing the disruption and displacement of people and businesses through long-range advance planning for major street improvements;

6. reducing environmental impacts, such as air pollution that results from transportation; and

7. increasing travel safety.

Thoroughfare planning objectives are achieved by both improving the operational efficiency of thoroughfares and by improving the system efficiency through system coordination and layout.

Operational Efficiency

The operational efficiency of a street is improved by increasing the street's capability to carry additional vehicular traffic and people. In terms of vehicular traffic, capacity is defined as the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical methods of improving vehicular capacity include street widening, intersection improvements, improved signalization, vertical and horizontal alignment improvements, and the elimination of roadside obstacles. For example, widening a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic, thereby reducing the impedances to traffic flow caused by slow moving or turning vehicles and the adverse effects of horizontal and vertical alignments.

The vehicular capacity of a road may be improved by several operational measures. The following are examples of operational ways to improve street capacity:

1. Control of access: A roadway with complete control of access can often carry three times the traffic handled by a non-controlled access street with identical lane width and number. An example of this would be I-40 (or the improvement recommended for US 70).

2. Parking removal: By removing parking along a roadway, capacity is increased since there is additional street width for traffic flow and the friction to flow caused by parking vehicles is reduced.

3. One-way operation: The capacity of a street can sometimes be increased by 20% to 50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

4. Reversible lanes: Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

5. Signal phasing and coordination: Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

6. Intelligent Vehicle Highway System (IVHS): This involves applying advanced concepts and technology in the area of communications, navigation, and information systems to provide solutions to traffic congestion and, at the same time, improve highway safety and reduce environmental effects. It covers passengers, freight, and public transit vehicles and fleets. The IVHS Program is structured according to five major system areas:

a. Advanced Traffic Management System - Provides real-time adjustment of traffic control systems and real-time means for transportation operators to effectively monitor traffic conditions and communicate to devices, quickly adjust traffic operations, and promptly respond to incidents.

b. Advanced Traveler Information System - Provides continuous advice regarding traffic conditions, alternate routes, and warnings regarding road safety.

c. Commercial Vehicle Operations - Improves operations efficiency and productivity of trucks, buses, and other fleets or vehicles and improves the efficiency of necessary regulatory activities.

d. Advanced Vehicle Control - Vehicle and/or roadway based electromechanical and communication devices that enhance the control of vehicles by facilitating and augmenting driver performance and ultimately relieving the driver of most tasks on designated instrumented roadways.

e. Advanced Public Transportation Systems - Providing mass transport users and operators (such as buses, vanpoolers, high-occupancy vehicle lanes, carpools, taxicabs) with up-to-date information on status, schedules, and availability of public transit systems including automatic vehicle location and monitoring systems to improve fleet management as well as electronic free media.

7. High-Occupancy Vehicle Lanes (HOV Lanes): This involves designating existing traffic lanes for exclusive use by high-occupancy vehicles such as carpools, vanpools, and buses. These can be altered according to demand to increase capacity. For example, some HOV lanes can be designated HOV only during peak hours and/or HOV lanes can be reversible between the morning and afternoon peak hours to reflect the shift in directional flow of traffic.

Altering travel demand is a third method of improving the vehicular capacity of existing streets. The capacity of a road can be increased without requiring physical changes to the characteristic of the road. Travel demand can be reduced or altered in the following ways:

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people-carrying capacity of the street system;

2. Promote the use of transit and bicycle modes;

3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer time period, thereby reducing peak hour demand;

4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

The two primary functions of roadways are traffic service and land service. However, when combined, these are basically incompatible. If the demand for traffic and land service are low, then this conflict is not serious. When traffic volumes are high, however, conflicts created by uncontrolled and intensely used adjacent property results in intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is to provide a functional system of streets which permits travel between origins and destinations with directness, ease, and safety. Various streets within the system are designed to perform specific functions, thereby minimizing traffic and land service conflict. Streets are categorized by function as local access streets, minor thoroughfares, or major thoroughfares.

Local access streets provide access to abutting property and are not intended to carry heavy volumes of traffic. The location of these facilities should dictate that only traffic having origins and destinations on those streets are served. Local streets may be further classified as either residential, commercial, and/or industrial, depending upon which type of land use they serve.

Minor thoroughfares are facilities which collect traffic from local access streets and carry this traffic to the major thoroughfares. In some instances, minor thoroughfares may supplement the major thoroughfare system by facilitation of minor through traffic movements. In addition, minor thoroughfares provide access to abutting property. They should be designed to serve limited areas in order to prevent their development as major thoroughfares.

Major thoroughfares are the primary traffic arteries of an area. The function of a major thoroughfare is to move intra-city and inter-city traffic. Since they are intended to carry traffic, the streets which comprise the major thoroughfare system are strongly discouraged from serving abutting property. They should not be bordered by uncontrolled strip development since such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to a major expressway with four or more travel lanes. Parking should normally not be permitted on major thoroughfares.

Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area is the radial-loop system. This system permits movement between various areas of the city with maximum directness. The functional elements of this system, shown in Figure 10, include radial streets, crosstown streets, loop system streets, and bypasses.

Radial streets service traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district (CBD) depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this, a system of crosstown streets forming a loop around the CBD is necessary. This system allows traffic to move from origins located on one side of the central area to destinations on the other side , following the border of the area. In addition, central area traffic is permitted to circle and then enter the area near a given destination. An effective crosstown system will free the central area of crosstown traffic, permitting the central area to function more adequately in its role.

Bypasses are designed to carry traffic through or around the urban area, removing traffic which has no desire to be in the city, thus providing relief to the city street system. Bypasses are normally designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volumes can be designed to function as a portion of an urban loop. A bypass will expedite the movement of through traffic, improving traffic conditions within the city. Since the local streets are freed for use by shopping and home-to-work travel, bypasses tend to increase the economic vitality of the local area.

Applications of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, functional classification, and the idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, a thoroughfare plan is developed for established urban areas and is constrained by the existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these constraints and the many other factors that affect major street locations.

Throughout the thoroughfare planning process, it is necessary from a practical viewpoint that the following basic principles be followed as closely as possible:

1. The plan should be derived from a thorough knowledge of today's travel - its component parts, as well as factors that contribute to it, limit it, and modify it.

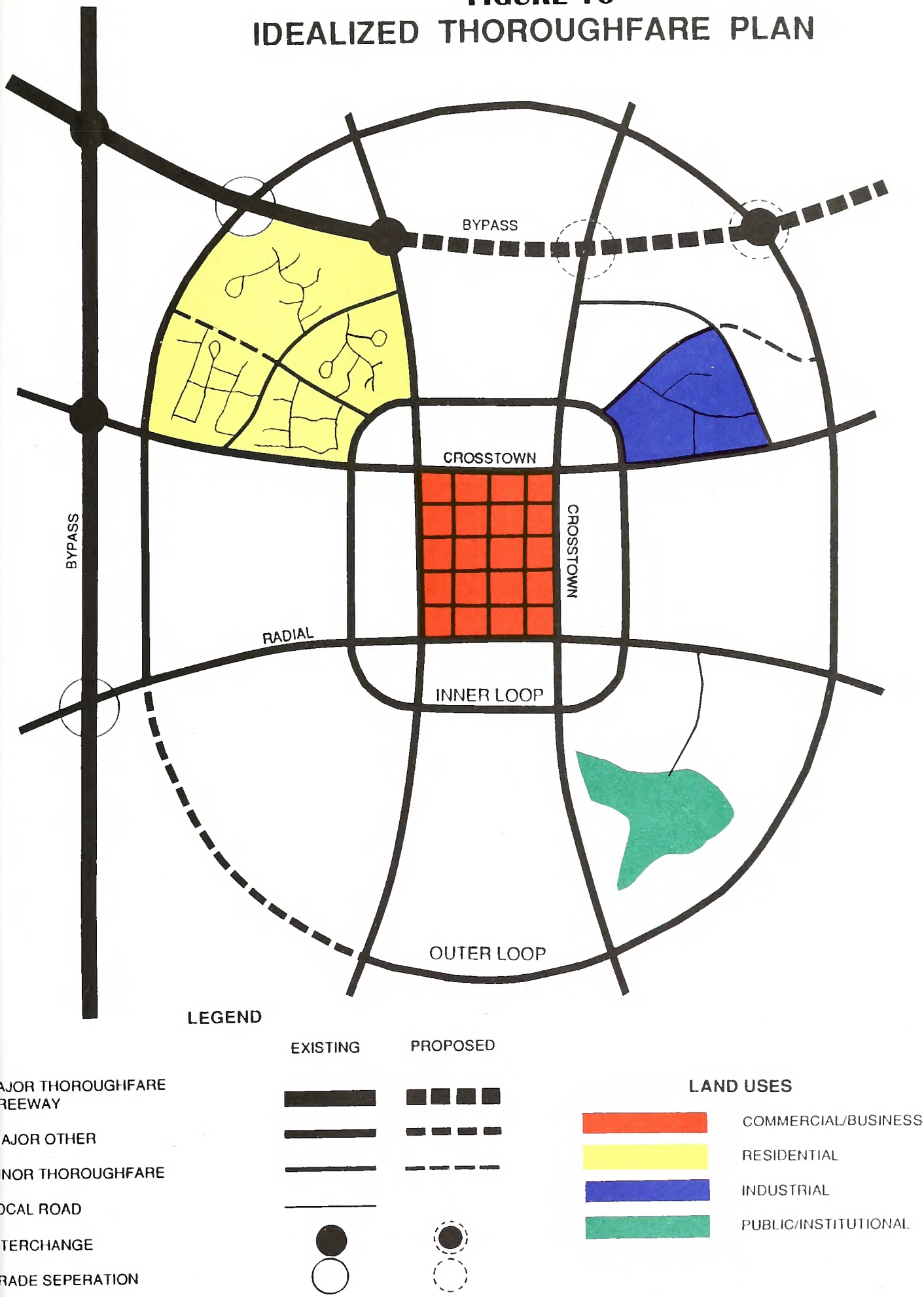
2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of all major traffic movements on relatively few streets.

3. The plan should conform to and provide for the land development plan of the area.

4. Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas which have development potential, it is necessary to designat thoroughfares on a long-range planning basis to protect right-of-way for future thoroughfare development.

5. While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

FIGURE 10
IDEALIZED THOROUGHFARE PLAN



APPENDICES

Appendix A:

Housing & Employment for Princeton

Zone #	Excellent Houses	Above Average	Average	Below Average	Poor
1	0	1	1	0	0
2	0	1	8	2	0
3	0	5	15	7	0
4	0	2	16	6	0
5	0	2	20	1	0
6	0	1	44	17	7
7	0	1	9	1	0
8	0	0	15	12	4
9	0	0	25	10	5
10	0	0	2	13	3
11	0	0	46	55	4
12	0	3	18	10	0
13	3	34	27	0	0
14	0	2	5	0	5
15	1	8	11	6	0
16	0	0	5	2	1
17	0	5	8	3	3
18	0	2	4	2	1
19	0	1	14	6	1
20	0	2	3	0	0
21	0	0	8	2	1
22	0	0	7	23	0
23	0	7	4	23	4
24	0	3	14	24	6
25	0	2	8	7	0
26	0	4	18	4	0
27	0	5	0	1	0
28	0	0	1	2	0
29	0	0	4	7	1
30	0	0	13	7	0
31	0	0	18	9	0
32	0	2	11	2	1
33	0	0	2	0	0
34	0	0	4	4	0
35	0	0	3	2	2
36	0	0	6	6	6

Zone #	Industrial Employees	Retail Employees	Highway Retail Employees	Office Employees	Service Employees
1	5	12	0	4	9
2	0	10	0	10	0
3	0	0	0	5	0
4	0	30	0	3	0
5	0	3	0	2	0
6	0	0	20	2	0
7	2	7	4	15	0
8	0	0	0	0	4
9	0	0	0	0	0
10	0	0	0	13	10
11	0	0	0	18	0
12	0	0	0	0	0
13	6	0	0	0	0
14	2	40	4	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	3	0	0	0
21	0	3	0	0	4
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	4
25	4	0	0	0	0
26	8	0	0	0	0
27	0	0	0	0	0
28	25	0	0	0	0
29	0	18	0	0	0
30	0	0	0	1	0
31	0	2	7	0	0
32	3	12	0	19	0
33	0	0	0	0	120
34	165	0	0	0	0
35	0	0	2	0	25
36	0	0	0	10	12

Zone #	Excellent Houses	Above Average	Average	Below Average	Poor
1	0	1	1	0	0
2	0	1	8	2	0
3	0	5	15	7	0
4	0	2	16	6	0
5	0	2	20	1	0
6	0	1	44	17	7
7	0	1	9	1	0
8	0	0	15	12	4
9	0	0	25	10	5
10	0	0	7	13	3
11	0	0	52	55	4
12	0	6	28	15	2
13	3	34	27	0	0
14	0	2	5	0	5
15	1	11	15	8	1
16	0	0	20	15	1
17	2	7	15	5	3
18	0	4	12	5	1
19	0	2	24	11	1
20	0	2	3	0	0
21	0	0	8	2	1
22	0	0	7	23	0
23	0	17	19	23	4
24	0	3	14	24	6
25	0	5	17	9	0
26	0	4	18	4	0
27	0	5	0	1	0
28	0	0	1	2	0
29	0	0	4	7	1
30	0	0	13	7	0
31	0	0	18	9	0
32	0	2	11	2	1
33	0	0	2	0	0
34	0	0	14	8	0
35	0	0	3	2	2
36	0	0	6	6	6

Zone #	Industrial Employees	Retail Employees	Highway Retail Employees	Office Employees	Service Employees
1	6	15	0	4	11
2	0	12	0	12	0
3	0	0	0	5	0
4	0	35	0	5	0
5	0	5	0	4	0
6	0	0	25	2	0
7	2	7	4	15	0
8	0	0	0	0	4
9	0	0	0	0	0
10	0	0	0	26	15
11	0	0	0	21	2
12	0	0	0	0	0
13	6	0	0	0	0
14	2	45	7	2	1
15	0	0	0	4	2
16	0	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	0	0	0
20	0	3	0	0	0
21	0	3	0	0	4
22	0	0	0	0	0
23	0	0	5	0	0
24	0	0	0	0	4
25	4	0	5	0	0
26	8	30	4	2	4
27	0	0	0	0	0
28	0	0	0	0	0
29	0	18	0	0	0
30	25	0	0	1	0
31	0	2	7	0	0
32	3	12	0	19	0
33	0	0	0	0	120
34	165	0	0	0	0
35	0	12	2	0	25
36	0	0	0	10	18

Appendix B:

Getting Projects in the Transportation Improvement Program (TIP)

Appendix B

Process for Placement of a Project in the Transportation Improvement Program

The process for attempting to get a project into the TIP is described briefly in this appendix.

The local planning board should first decide on which projects they would like funded and placed in the TIP book. They should not try and attempt to get all of the improvements recommended in the thoroughfare plan into the TIP but select carefully a few of the projects that would provide the greatest impact on the traffic network in the area. These projects should be prioritized by the planning board and summarized briefly, as shown on Appendix Page B-2.

After determining which projects are needed in the area then an official letter for the TIP Project Request should be written to the N.C. Board of Transportation member from the municipality's respective district. Along with the letter, should be the prioritized summary of proposed projects for funding, a TIP Candidate Project Request Form for every project that is to be considered for funding and inclusion in the TIP, and a map that describes the location of each project that is being proposed for funding. This process occurs every two years. An example of each one of these items is included in this appendix on the pages that follow.

TOWN OF WAXHAW

P. O Box 6
317 N. Broome St. – Waxhaw, N.C. 28173
Telephone 704-843-2195 – Fax 704-843-2196

Hours: Mon.-Tues.-Thur.-Fri. – 8:00 A.M. to 5:00 P.M.
Wednesday – 8:00 A.M. to 12:00 Noon

October 28, 1997

N. C. Board of Transportation
N. C. Department of Transportation
P. O. Box 25201
Raleigh, North Carolina 27611-5201

Re: 1998 TIP Project Requests for the Town of Waxhaw, NC

Dear Chairman and Committee Members:

Enclosed please find the projects requested by the Town of Waxhaw for consideration in the next TIP update. You will find a list of prioritized projects as approved by the Town Commissioners. You will also find a description of the need for each project as well as the traffic volumes in the Waxhaw area.

Our town commissioners endorses the existing feasibility study of the NC 16 corridor and potential widening of this facility. However, we would like to see the widening of NC 16 to four lanes to stop immediately outside the town limits and continue on into town as we have suggested in the following attachments.

We thank each of you for the opportunity to participate in the development of the TIP and feel that these projects are worthy of inclusion in the 1998 TIP update. Please contact us immediately if additional information is needed concerning any of the enclosed project requests.

Sincerely,

Jack M. Hemby

Jack Hemby
Mayor

Enclosures

Priority and Needs for the Requested TIP Projects

Priorities

1) **NC 16 from NC 75 to Twelve Mile Creek -**
   * Widen to accommodate traffic
   * Request Project Funding and Schedule

2) **Waxhaw Loop (Section 1) -**
   * Section of the loop from that extends from NC 75east of town to NC 16 north of town.
   * Request funding for a new roadway that serves as a bypass for through travel from Charlotte to Monroe.

3) **Waxhaw Loop (Section 2) -**
   * Section of the loop that extends from NC 75 (East of town) south to Providence Road South (SR 1117)
   * Request feasibility study for a new roadway that serves local traffic getting from the primary residential locations north of town to the three schools that are located south of town

4) **Waxhaw Loop (Section 3) -**
   * Section of the loop that extends from NC 16 to the southwest to NC 75
   * Request a feasibility study for a new roadway that will serve through traffic going from Charlotte to South Carolina

Needs

The Town of Waxhaw is one of the fastest growing small communities in the state. It is evident that this town is quickly becoming a "bedroom town" for the Charlotte Metropolitan Area due to the atmosphere of the community and its isolation from the hustle and bustle of a large city. Although pleased with the residential growth in the area, the concern is for the decline of the transportation system at the expense of this growth. Therefore the need for some transportation improvements in the town is necessary. The following is a brief description of the needs of the prioritized projects listed above. Following these descriptions are the project fact sheets for each of the prioritized projects.

Highway Program
TIP Candidate Project Request

Date 10/23/97 Priority No. 1

County Union City/Town Waxhaw

Requesting Agency Town of Waxhaw NCTIP No. R-3802 (if available)

Route (US, NC, SR/Local Name) NC 16

Project Location (From/To/Length) From the Twelve Mile Creek bridge to NC 75

Length = 1.8 miles

Type of Project (Widening, New Facility, Bridge Replacement, Signing, Safety, Rail Crossing, Bicycle, Enhancement, etc.)
Widening

Existing Section

Existing Cross Section 28 feet (K) Type 2 lane with paved shoulders

Existing Row 70' Feet 1997 ADT 9000

Proposed Section

Proposed Cross Section 70 feet (C) Proposed ROW 90 feet

Type 5 Lane from 12 Mile Creek to Hickory Grove shopping center (Simonetti Dr) & 3 Lanes from Simonetti Dr to NC 75

2025 ADT 19100

Estimated Cost, ROW $ 200,000 Construction $ 3.8 Million

Brief Justification for Project This major thoroughfare exists as a 2 lane facility from Waxhaw to Charlotte. The volumes are expected to increase dramatically because of the residential development along NC 16. This widening will increase the capacity and allow for this area to develop comfortably without worsening the transportation network in the area.

Project Supported By (Agency/Group) Town of Waxhaw, Centralina Council of Governments, Statewide Planning Branch of NCDOT

Other Information/ Justification

- ☒ Part of Thoroughfare Plan
- ☐ Part of Comprehensive Plan
- ☐ Serves School
- ☐ Serves Hospital
- ☐ Obsolete Facility
- ☐ Serves Park
- ☐ High Accident (#)
- ☒ Feasibility Study in 1997 TIP

PRIORITIZED PROJECTS

FOR THE TOWN OF

WAXHAW

LEGEND

- 1st Priority (NC 16 widening)
- 2nd Priority (Howie Pkwy Section A)
- 3rd Priority (Howie Pkwy Section B)
- 4th Priority (Howie Pkwy Section C)
- 5th Priority (Old Providence Rd Widening)
- 6th Priority (Waxhaw–Marvin St Widening)

N

S

WAXHAW

UNION COUNTY
NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALES

0 0.25 0.5 1.0
miles

0 1000 2000 4000 6000
feet

Map Date 12-04-97

Appendix C:

Princeton Street Tabulations

Appendix C - Street Tabulations for the Town of Princeton

This appendix displays the details of the street network that has been proposed for the Town of Princeton in this Thoroughfare Plan. The chart describes the conditions that exist in 1995 and what the roadways should look like in the year 2025. It shows the recommended number of lanes, the right-of-way required for this type of roadway and a sketch showing the required dimensions for each type of roadway. In order for the Town to know what right-of-way will be required in the future for some of these roads the column labeled X-section will give a letter representing the type of cross-section that is recommended for that roadway. That letter can then be found on the figures that follow to determine the right-of-way length in feet or meters that needs to be reserved or protected.

Appendix C-Princeton
Street Tabulations

Facility & Segment		Existing Road System (1995)									Future (2025)				
		Distance		Roadway			ROW		Capacity	AADT	Capacity	AADT	X-section	ROW	
from*	to	(miles)	(km)	(ft)	(m)	lanes	(ft)	(m)	(vpd)	(vpd)	(vpd)	(vpd)		(ft)	(m)
US 70															
Wayne County Line	Pine St (SR 1002)	1.27	2.04	48	15	4	200	61	37,700	17,100	75,000	49,100	D	110	34
Pine St. (SR 1002)	US 70 Business (W of town)	0.69	1.11	48	15	4	240	73	37,700	17,200	75,000	50,800	D	110	34
US 70 Business (W of town)	SR 2314	1.02	1.64	48	15	4	240	73	37,700	18,900	75,000	52,600	D	110	34
US 70 B															
US 70 (ECL)	Pearl St. (SR 2372)	0.74	1.19	22	7	2	60	18	12000	2500	12000	3700	K	60	18
Pearl St. (SR 2372)	Pine St (SR 1002)	0.2	0.32	33	10	3	60	18	12000	3500	12000	4700	K	60	18
Pine St. (SR 1002)	(SR 2316)	0.23	0.37	33	10	3	60	18	12000	3000	12000	4800	K	60	18
(SR 2316)	US 70 WCL	0.44	0.71	22	7	2	60	18	12000	1500	12000	2700	K	60	18
Pine Street (SR 1002)															
New Ballpark Rd (SR2533)	3rd Street	0.33	0.53	20	6	2	60	18	NA**	200	12000	500	K	60	18
3rd Street	Railroad Ave	0.2	0.32	20	6	2	60	18	11000	2000	11000	2800	K	60	18
Railroad Ave	US 70	0.45	0.72	20	6	2	60	18	11000	3200	20000	5400	H	60	18
US 70	Little River	1.1	1.77	20	6	2	60	18	12000	3000	12000	4800	K	60	18
Pearl Street (SR 2372)															
SR 2537	3rd Street	1.22	1.96	26	8	2	60	18	11000	750	11000	1500	K	60	18
3rd Street	US 70 B	0.36	0.58	26	8	2	60	18	12000	1200	12000	2700	K	60	18
US 70 B	Little River	1.48	2.38	26	8	2	60	18	11000	500	13000	2200	K	60	18
Pierce Street (SR 2535)															
3rd Street	SR 2538	1.21	1.95	18	5	2	60	18	9000	800	9000	1500	K	60	18
Third Street															
James Street	Pine Street	0.14	0.23	20	6	2	60	18	10000	1200	10000	1700	K	60	18
Pine Street	Pierce Street	0.37	0.60	20	6	2	60	18	10000	1000	10000	1500	K	60	18
James Street															
US 70	End of N James	0.038	0.06	18	5	2	60	18	9000	100	9000	300	K	60	18
End of N James	Lee Street	0.057	0.09	--	--	--	--	--	--	--	9000	200	K	60	18
Lee Street	Pool Street	0.076	0.12	18	5	2	60	18	9000	200	9000	200	K	60	18
Pool Street	Linda Street	0.057	0.09	--	--	--	--	--	--	--	9000	200	K	60	18
Holts Mill Road (SR 2531)															
Moccasin Creek	Third Street	1.21	1.95	22	7	2	60	18	12500	1500	12500	3000	K	60	18
New Ballpark Road (SR 2533)															
Holts Mill Road (SR 2531)	Pearl St (SR 2372)	0.59	0.95	28	9	2	60	18	NA**	200	12000	1200	K	60	18
Pearl St. (SR 2372)	Pierce St (SR 2535)	0.36	0.58	28	9	2	60	18	12000	200	12000	500	K	60	18
Center Street															
New Ballpark Road (SR 2533	3rd St	0.32	0.52	18	5	2	60	18	NA**	200	11000	600	K	60	18
3rd St	US 70 B	0.33	0.53	18	5	2	60	18	8000	500	8000	800	K	60	18
Old Cornwallis Road (SR 2371)															
Old Rock Quarry Rd(SR 2316	US 70	2.75	4.43	18	5	2	60	18	9000	1000	9000	2200	K	60	18
Old Rock Qyarry Road (SR2316)															
US 70 B	US 70	0.27	0.43	18	5	2	60	18	9000	800	13000	1800	K	60	18
US 70	Old Cornwallis(SR 2371	1.21	1.95	18	5	2	60	18	9000	1000	13000	2800	K	60	18

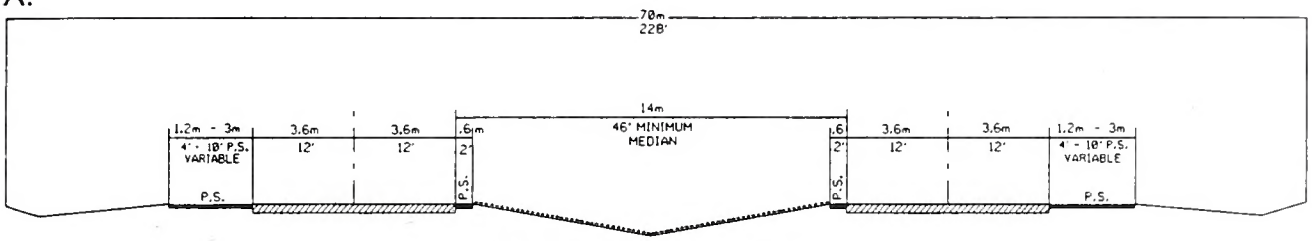
* ECL= East of City Limits ** Road Not Paved Currently
WCL = West of City Limits

Appendix D:

Typical Thoroughfare Cross Sections

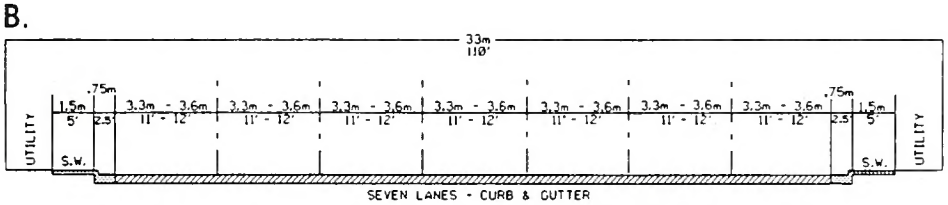
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



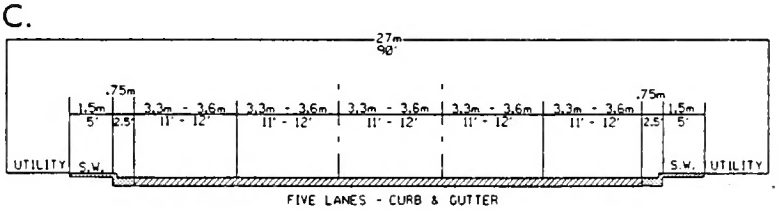
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



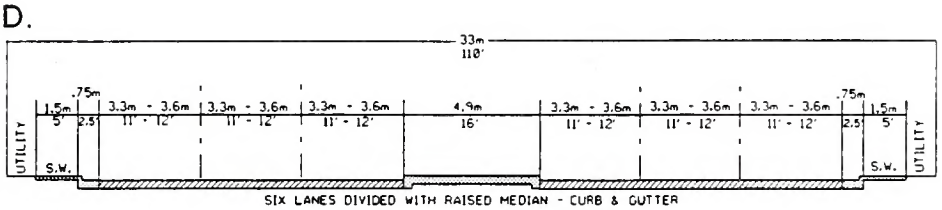
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

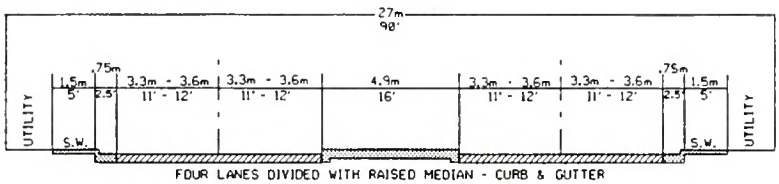
D.



SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

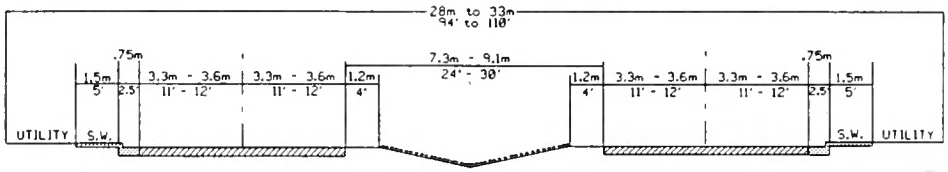
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



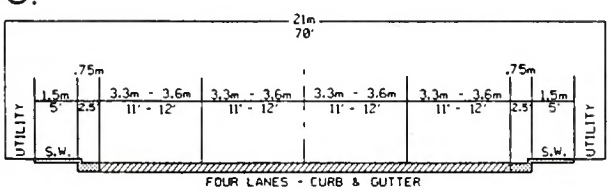
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



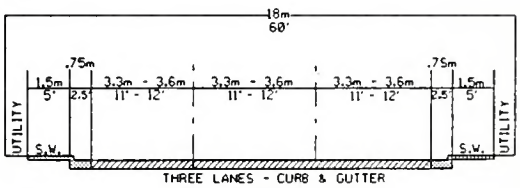
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



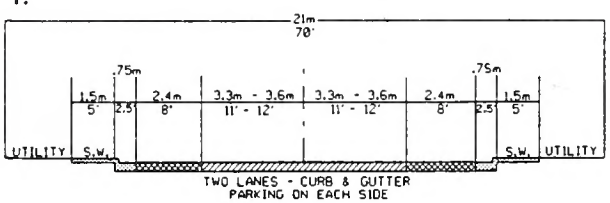
FOUR LANES - CURB & GUTTER

H.



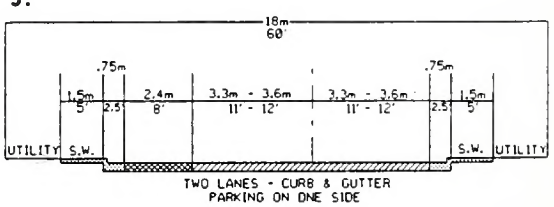
THREE LANES - CURB & GUTTER

I.



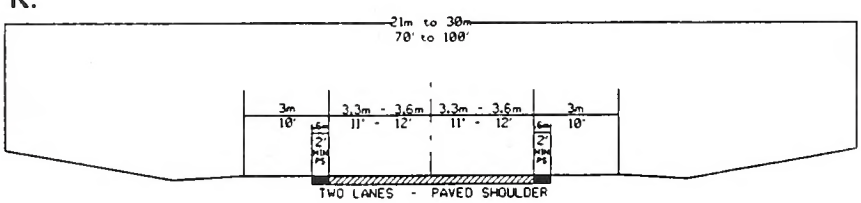
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

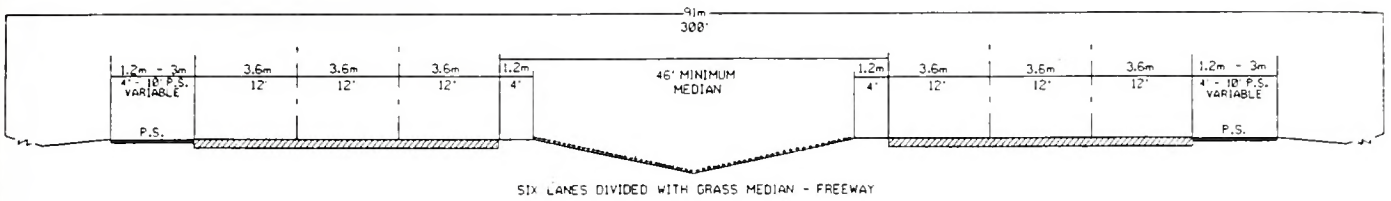
K.



TWO LANES - PAVED SHOULDER

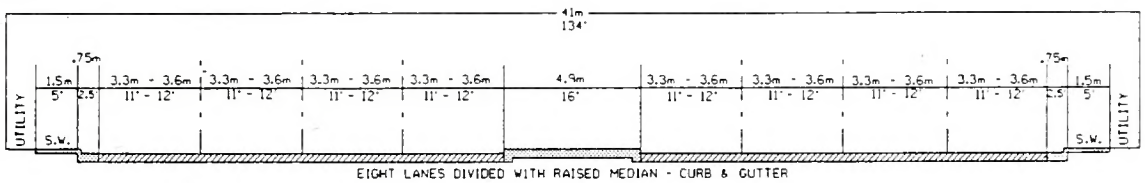
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

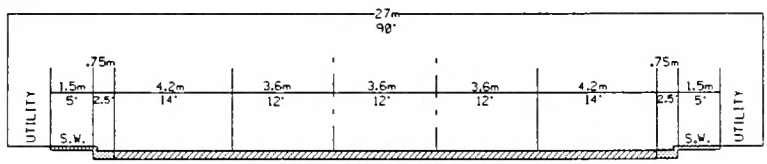
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

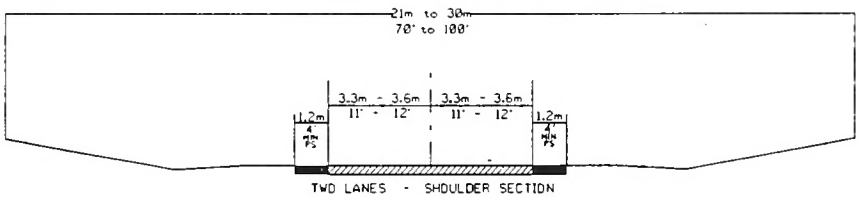
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



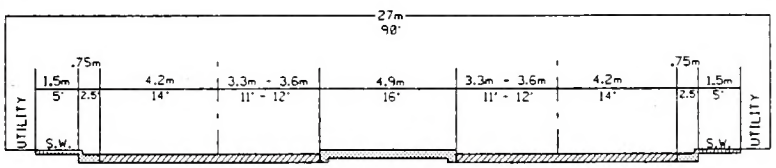
FIVE-LANE ROADWAY WITH CURB & GUTTER.
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



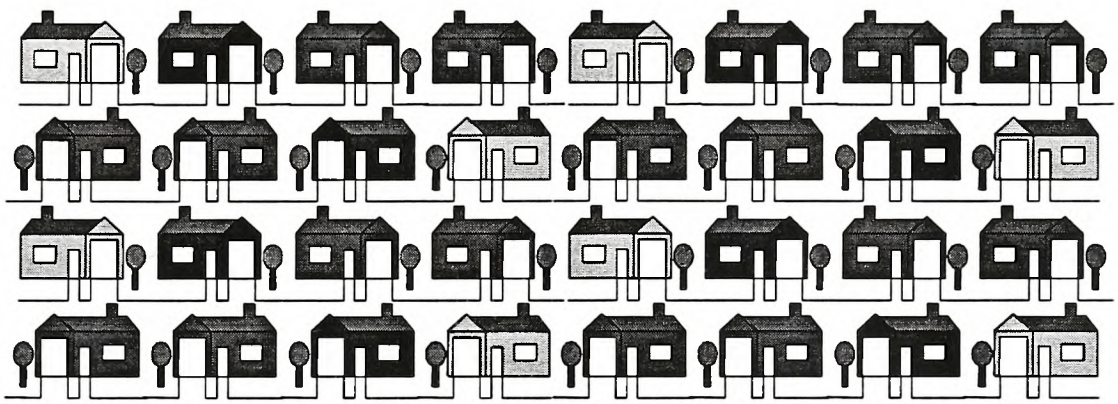
TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER.
STANDARD INSIDE LANES & WIDENED CURB LANES

Appendix E:



Recommended Subdivision Standards

Appendix E

Recommended Subdivision Ordinances[1]

Definitions

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intrastate and inter-county service at relatively high overall speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provide access to the arterial system.

4. Minor Collector - a road which provides service to small local communities and traffic generators and provides access to the major collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of interstate, other freeway, expressway, or parkway roads and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perfrom the function of collecting traffic from local streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

---

[1]The following design standards are in Metric and English units.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane road- ways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major inter- sections. A parkway is for non-commercial traffic, with full or partial control of access.

2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 750 meters (2500 ft) in length, or streets less than one and a half kilometers in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development

and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than four hectares where no street right-of-way dedication is involved, (3) the public acquisition, by purchase, of strips of land for the widening or the opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than 0.8 hectares (.32 acres) into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality. The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

1. Rural	**Min. ROW(m)**	**Min. ROW(ft)**
a. Principle Arterial - Freeways	105 meters	350 feet
- Other	60 meters	200 feet
b. Minor Arterial	30 meters	100 feet
c. Major Collector	30 meters	100 feet
d. Minor Collector	24 meters	80 feet
e. Local Road	18 meters	60 feet

2. Urban	Min. ROW(m)	Min. ROW(ft)
a. Major Thoroughfare other than Freeway and Expressway	27 meters	90 feet
b. Minor Thoroughfare	21 meters	70 feet
c. Local Street	18 meters[1]	60 feet
d. Cul-de-sac	Variable[2]	

The subdivider will only be required to dedicate a maximum of 30 meters (100′) of right-of-way. In cases where over 30 meters (100′) of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 30 meters (100′). On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than eighteen meters in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. *Local Residential*
   Curb and Gutter section: 7.8 meters (26′), face to face of curb
   Shoulder section: 6 meters (20′) to edge of pavement, 1.2 meters (4′) for shoulders

2. *Residential Collector*
   Curb and Gutter section: 10.2 meters (34′), face to face of curb
   Shoulder section: 6 meters (20′) to edge of pavement, 1.8 meters (6′) for shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

---

[1] The desirable minimum right-of-way (ROW) is 18 meters (60′). If curb and gutter is provided, 15 meters (50′) of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

1. Design Speed - The design speed for a roadway should be a minimum of 10 km/h greater than the posted speed limit. The design speeds for subdivision type streets shall be:

Facility Type	Design Speed					
	Desirable		Minimum			
			Level		*Rolling*	
	km/hr	mph	km/hr	mph	km/hr	mph
Rural						
Minor Collector Roads	100	60	80	50	70	40
Local Roads Including Residential Collectors and Local Residential	80	50	80	50	70	40
Urban						
Major Thoroughfares other than Freeway or Expressway	100	60	80	50	80	50
Minor Thoroughfares	100	60	80	50	70	40
Local Streets	70	40	70	40	50	30

2. Maximum and Minimum Grades

   a. The maximum grades in percent shall be:

Facility Type	Design Speed (km/h)	Design Speed (mph)	Maximum Vertical Grade (Percent)		
			Flat	Rolling	Mountainous
Rural					
Minor Collector Roads*	30	20	7	10	12
	50	30	7	9	10
	60	35	7	8	10
	90	55	6	7	9
	100	60	5	6	8
	110	70	4	5	6
Local Roads Including Residential Collectors & Local Residential Streets*	30	20	--	11	16
	50	30	7	10	14
	60	35	7	9	12
	90	55	6	8	10
	100	60	5	6	--
Urban					
Major Thoroughfares other than Freeway or Expressway	50	30	8	9	11
	60	35	7	8	10
	90	55	6	7	9
	100	60	5	6	8

Design Speeds Continued

Minor Thoroughfares[1]	30	20	9	10	12
	50	30	9	9	10
	60	35	9	8	10
	90	55	7	7	9
	100	60	6	6	8
	110	70	5	5	6
Local Streets[1]	30	20	-	12	17
	50	30	8	11	15
	60	35	8	10	13
	90	55	7	9	11
	100	60	6	7	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters (105') each way from intersections (measured from edge of pavement) should not exceed 5%.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

Sight Distance

Design Speed		Stopping Sight Distance			
		Minimum		*Desirable Minimum*	
km/h	mph	meters	feet	meters	feet
30	20	30	100	30	100
50	30	60	200	70	250
60	35	80	275	90	300
90	55	140	500	170	600
100	60	160	525	210	700

Design Speed		Minimum K2 Value for:			
		Crest		*Sag*	
km/h	mph	meters	feet	meters	feet
30	20	3	10	4	20
50	30	10	30	12	40
60	35	18	50	18	50
90	55	71	160	40	130
100	60	105	310	51	160

[1] For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters long (500'), grades may be 2% steeper than the values in the above table

[2]K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

4. The "Superelevation Table" shown below and continued on the next page shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

Superelevation Table

Design Speed		**Maximum e**	**Minimum Radius**	
km/h	*mph*		*meters*	*feet*
50	30	0.04	100	302
60	40	0.04	150	573
90	50	0.04	375	955
100	60	0.04	490	1528
50	30	0.06	90	273
60	40	0.06	135	509
90	50	0.06	335	849
100	60	0.06	435	1380
50	30	0.08	80	252
60	40	0.08	125	468
90	50	0.08	305	764
100	60	0.08	395	1206

e = rate of roadway superelevation, meter per meter

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters (200') between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters (500') in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should

not be less than the distance from the edge of pavement to right-of-way line on the stre approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existir street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least 6 meters (20′).

3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead-end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9 meters (30′) from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters (6′) from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:
   a. Shoulder section approach
      I. Under 800 ADT design year
         Minimum 8.4 meters (28′) width face to face of parapets, rails, or pavement width plus 3 meters (10′), whichever is greater.

II. 800 - 2000 ADT design year

Minimum 10.2 meters (34′) width face to face of parapets, rails, or pavement width plus 3.6meters (12′), whichever is greater.

III. Over 2000 ADT design year

Minimum width of 12 meters (40′), desirable width of 13.2 meters (44′) width face to face of parapets or rails.

b. Curb and gutter approach

I. Under 800 ADT design year

Minimum 7.2 meters (24′) face to face of curbs.

II. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters (1′ 6″), or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m (8′) minimum, 3 m (10′) desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

English To Metric Conversion Table

English Units		S.I. Units	Abbreviation
1 inch	equals	25.4 millimeters	(mm)
1 foot	equals	0.3 meters	(m)
1 mile	equals	1.6 kilometers	(km)
1 acre	equals	2.47 hectares	(hect)

Metric Equivalents

1 millimeter	equals	0.001 meters
1 kilometer	equals	1000 meters
1 hectare	equals	10,000 square meters